PB82-103763

The APRAC-3/MOBILE 1 Emissions and Diffusion Modeling Package: User's Manual

SRI International
Menlo Park, CA

Prepared for

Environmental Protection Agency
San Francisco, CA

Jul 81

U.S. Department of Commerce
National Technical Information Service
NTIS

EPA 909-9-81-002

PB82-103763

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User's Manual

July 1981

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Prepared for:

U.S. Environmental Protection Agency
Region IX
215 Fremont Street
San Francisco, California 94105

Contract 68-02-2548

SRI Project 8855

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REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA 22161

50272-101

REPORT DOCUMENTATION PAGE

1. REPORT NO. EPA 909-9-81-002

2.

3. Recipient's Accession No. PB82 103763

4. Title and Subtitle
USER'S MANUAL FOR THE APRAC-3/MOBILE1 EMISSIONS AND DIFFUSION MODELING PACKAGE

5. Report Date
July 1981

6.

7. Author(s)
P.B. Simmon, R.M. Patterson, F.L. Ludwig, L.B. Jones

8. Performing Organization Rept. No.

9. Performing Organization Name and Address
Atmospheric Science Center
SRI International
333 Ravenswood Avenue
Menlo Park, California 94025

10. Project/Task/Work Unit No.
8855

11. Contract(C) or Grant(G) No.
(C) 68-02-2548
(G)

12. Sponsoring Organization Name and Address
Environmental Protection Agency
Region IX
215 Fremont Street
San Francisco, California 94105

13. Type of Report & Period Covered
FINAL

14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

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17. Document Analysis a. Descriptors
Air Pollution
Vehicular Traffic
Mathematical Models

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group 13B,05I

18. Availability Statement
Release Unlimited

19. Security Class (This Report)
Unclassified

20. Security Class (This Page)

21. No. of Pages

22. Price

(See ANSI-Z39.18)

See Instructions on Reverse

OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

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ABSTRACT

Instructions for the use and regarding the applicability of the APRAC-3/MOBILE1 emissions and diffusion model are presented in this manual. The previous version of the model, APRAC-2, completely revised the methodology of the original model, APRAC-1A. The latest version of the model remains basically the same as APRAC-2 with the exception of two important modifications. First, the emission factor computation methodology has been revised to reflect the EPA's latest update, and the portion of the code that performs those computations has been separated from the model's emission rate and diffusion modules to facilitate incorporation of future emission factor methodology updates. The second modification to the model will increase computation efficiency by automatically treating traffic links in the primary network with low vehicle miles traveled (VMT) as area sources. This will allow the remaining primary link file to fit into core storage rather than incurring the numerous and expensive input/output operations necessary when the primary traffic file is large.

As with APRAC-2, gridded and link-by-link emissions can be output for hydrocarbons, carbon monoxide, or oxides of nitrogen. Diffusion calculations make use of a receptor-oriented Gaussian plume model. Local winds at the receptor can be used; they are interpolated from multiple wind inputs. Mixing heights may be calculated from sounding data or input directly. Two local source models are available, one treating pollutant behavior in a street canyon and the other treating vehicle and pollutant effects at a signalized intersection. A small program is also included for decoding Federal Highway Administration data tapes.

ACKNOWLEDGMENTS

The APRAC-1A model was developed in 1970 and improved in 1971 and 1972. In 1977 the model underwent major revision and was renamed APRAC-2. The further modification of APRAC-2, detailed in this manual, produced the APRAC-3/MOBILE1 modeling package. Over the years a number of people, besides the authors of this manual, have contributed to these studies. Involved in the APRAC-1A effort were R.L. Mancuso, W.B. Johnson, W.F. Dabberdt, and A.E. Moon. For the APRAC-2 study, R.C. Sandys, J.C. Bobick, L.R. Seiders, J. Carr, B. Wheeler, and L. Gasiorek joined the project team. Joyce Kealoha is responsible for most of the illustrations in this and other APRAC manuals, and Barbara Wildman for the typing and assembly of the manual.

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LIST OF ABBREVIATIONS

APRAC	-Air Pollution Research Advisory Committee
CBD	-Central Business District
CO	-Carbon Monoxide
CO_2	-Carbon Dioxide
DIFMOD	-Diffusion Module
EMOD	-Emission Rate Module
FHWA	-Federal Highway Administration
FTP	-Federal Test Procedure
gpm	-Grams/Vehicle-Mile
HC	-Hydrocarbons
HDD	-Heavy-Duty Diesel-Powered Trucks
LDT1	-Light-Duty Trucks (0 - 6000 lb gross vehicle weight)
LDT2	-Light-Duty Trucks (6001 - 8500 lb gross vehicle weight)
LDV	-Light-Duty Vehicles
MC	-Motorcycles
MOBILE1	-Mobile Source Emission Factor Program
NO_x	-Oxides of Nitrogen
PREMOD	-Emission Factor Preprocessing Module
VMT	-Vehicle Miles Traveled

SECTION 1

INTRODUCTION

The APRAC-1A[*] urban diffusion model was designed to be practical, i.e., to use readily available inputs to calculate pollutant concentrations. The development of the model has been chronicled in several reports (Ludwig et al., 1970, 1972; Johnson et al., 1971; Mancuso and Ludwig, 1972). The APRAC-2 model was a natural descendant of the APRAC-1A. It maintained basically the same approach to the simulation of atmospheric diffusion, but incorporated advances in the estimation of vehicular emissions and in the dissemination of traffic information.

The APRAC-3/MOBILE1 modeling package continues the APRAC-2 approach, but incorporates the latest emission factor estimation procedure. Emission factor computation has been removed from the main portion of the model. An emission factor preprocessor has been developed that consists of a "driver" program that couples with the EPA's mobile source emission factor program (MOBILE1). The preprocessor is run first and independent of the APRAC-3 emission rate and dispersion modules to produce the emission factors required by these modules. The separation of emission factor computations from the rest of the model was effected to minimize changes to the modeling package that will be required when future updates to the EPA methodology are released. When an update is released, the emission rate and dispersion module part of the program (called the main program in this manual) will not need to be altered at all. Some change to the driver part of the preprocessor, however, may be required for it to attach to MOBILE2 or what will be the next version of the emission factor methodology.

Another change that was made to the APRAC-2 methodology concerns access of the primary traffic link file. The capability for using data from a nearly unlimited number of road and street segments, which was introduced in APRAC-2, added to the use of supplemental storage systems and to the core-storage requirements. As a result, the model was not as economical as APRAC-1A. To mitigate this problem, the user may invoke optional logic that was added in APRAC-3 to sort the primary link file and combine the emissions of links having low usage with the emissions of the secondary traffic network. Thus, the number of links in the primary traffic file can be reduced to a number that can be contained in core storage, eliminating the need for numerous input/output operations and reducing computer running costs.

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[*] The acronym APRAC is derived from the initial letters of the Air Pollution Research Advisory Committee, under whose auspices the original research was conducted.

If the region to be modeled contains a large number of heavy usage links, the file reduction option should not be used. Rather, the user may want to identify time periods of importance with a very simple, fast-running model and then study the identified periods in greater detail with the complete model. For example, Ludwig and Kealoha (1975) have described a very simple model that can be used to select time periods for detailed study.

Included in this manual are descriptions of the modifications made to APRAC-1A in developing APRAC-2 that are retained in APRAC-3. One of the most important characteristics of APRAC-2 is its ability to make full use of the historic records and the projections available from the Federal Highway Administration's battery of computer programs. The model also provides for use of detailed wind data in the calculations. Mixing depth information from alternative sources can be used. The model provides as outputs the amount of pollutant emitted in grid squares throughout the area.

In this user's manual, we have tried to focus on the information necessary to operate the computer program. The information required is mainly an extensive list of inputs and outputs, but because intelligent operation also requires some knowledge of the underlying theory, discussions of the theory are provided along with references to more detailed descriptions.

Some users will want to modify the code to meet their own special needs. While it is not the purpose of this manual to serve as a guide for the "customizer," we have tried to make modifications somewhat easier by providing flow charts for the more complicated subroutines and by the liberal use of comments within the FORTRAN code.

SECTION 2

GENERAL DESCRIPTION OF THE MODEL

A. Background

The APRAC-3/MOBILE1 modeling package has three major components: an emission factor preprocessing module (called PREMOD), an emission rate module (called EMOD) and a diffusion module (called DIFMOD). The difference between the two emissions-related modules is that the preprocessor computes emission factors, while the emission rate module computes emission rates.

When using the modeling package, the emission factor preprocessing module must always be run first, independent of the rest of the model. The output of the preprocessor is part of the input for the remainder of the model. The emission rate and diffusion modules together are called the main program. However, the emission rate module can operate without the diffusion module, but the diffusion module requires the output of the emission rate model to use as input. To use the emissions module without making diffusion calculations, only those subroutines associated with EMOD need be used (see Appendix A).

Each of these modules has several major components. The emission factor preprocessing module consists of a driver program that couples with MOBILE1, EPA's computer program of its mobile source emission factor computation methodology, to compute tables of emission factors to be used in the APRAC-3 emissions and diffusion modules. The emission rate module has components to determine emissions on each roadway link and to estimate the emissions within each grid square.

The three major functions of the diffusion model are to:

(1) Calculate diffusion.

(2) Derive, from conventional meteorological information, the stability, mixing depth, and wind parameters used by the model.

(3) Simulate small-scale effects near the receptor.

There are two subroutines in the small-scale effects category: one treats street canyon conditions and the other simulates traffic and dispersion in the vicinity of an intersection.

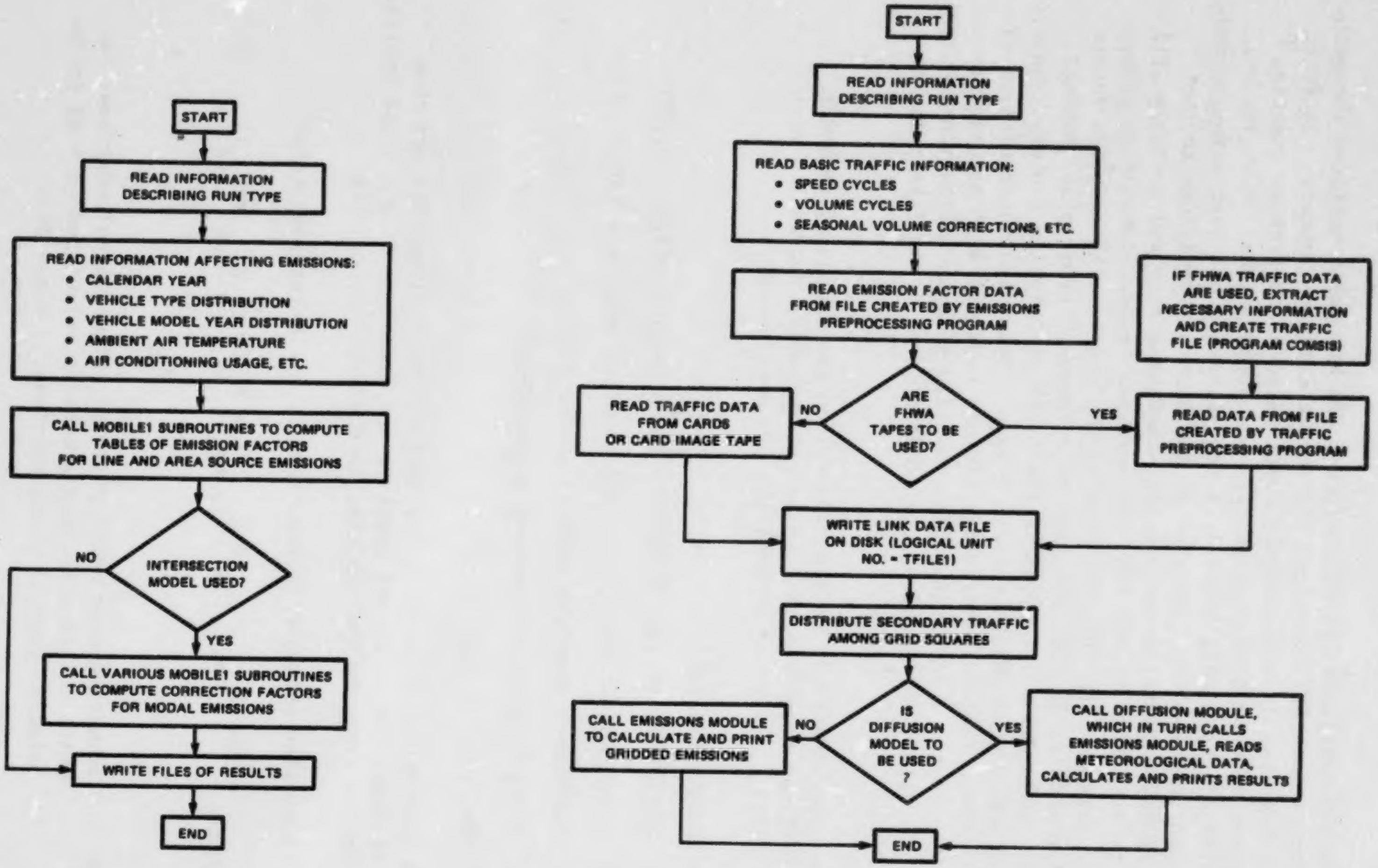
When the diffusion module is used, one of two types of traffic file reorganizations occur, according to what the user has specified. If computational efficiency is called for, the model will sort through the traffic file, choose and retain the links with the highest emissions, and assign the emissions from the remaining links to the secondary traffic grid. Otherwise, the entire file is reorganized but not reduced. With all but the largest computers it is seldom possible to store all of the traffic link information in the central memory, so the model reorganizes the file so that links near the receptor may be easily identified and only those links are stored in core at any one time.

The overall organization of the modeling package is shown in Figure 1. The emission factor preprocessor is shown in Figure 1(a). Basically, this program reads information describing the type of run to be made and parameters that affect emissions, calls subroutines to compute the appropriate emission factors, and writes the results on a file in a form ready for use by the remainder of the model.

The main part of the model (the emission rate and diffusion modules) is shown in Figure 1(b). Essentially, a main program supplies the information that defines the run type. It also reads basic traffic information. It then calls either the emission rate module or the diffusion module. If the diffusion module is called, it will call the emission rate module at the appropriate point during the calculations.

B. Emission Factor Preprocessing Module (PREMOD)

In the original version of this regional-scale dispersion model, APRAC-1A, emissions calculations were made from a simple equation that was incorporated with other parts of the calculations. A few years ago, EPA developed much more complex methods for estimating emissions (Kircher and Williams, 1975). The incorporation of those newer methods into the calculations required extensive modifications to the computer program. Virtually nothing remained of the methods used to calculate emissions in the original model. Some of the simplifications that were formerly used to speed calculations were eliminated with the old methods. The revisions allowed the emission model to treat hydrocarbons (HC) and oxides of nitrogen (NO_x), as well as the carbon monoxide (CO) emissions for which it was originally designed. The version of APRAC-1A that contained these revisions (among others) was called APRAC-2.


START
READ INFORMATION DESCRIBING RUN TYPE
READ INFORMATION AFFECTING EMISSIONS:
• CALENDAR YEAR
• VEHICLE TYPE DISTRIBUTION
• VEHICLE MODEL YEAR DISTRIBUTION
• AMBIENT AIR TEMPERATURE
• AIR CONDITIONING USAGE, ETC.
CALL MOBILE1 SUBROUTINES TO COMPUTE TABLES OF EMISSION FACTORS FOR LINE AND AREA SOURCE EMISSIONS
INTERSECTION MODEL USED?
NO
YES
CALL VARIOUS MOBILE1 SUBROUTINES TO COMPUTE CORRECTION FACTORS FOR MODAL EMISSIONS
WRITE FILES OF RESULTS
END
START
READ INFORMATION DESCRIBING RUN TYPE
READ BASIC TRAFFIC INFORMATION:
• SPEED CYCLES
• VOLUME CYCLES
• SEASONAL VOLUME CORRECTIONS, ETC.
READ EMISSION FACTOR DATA FROM FILE CREATED BY EMISSIONS PREPROCESSING PROGRAM
IF FHWA TRAFFIC DATA ARE USED, EXTRACT NECESSARY INFORMATION AND CREATE TRAFFIC FILE (PROGRAM COMSIS)
ARE FHWA TAPES TO BE USED?
NO
YES
READ TRAFFIC DATA FROM CARDS OR CARD IMAGE TAPE
READ DATA FROM FILE CREATED BY TRAFFIC PREPROCESSING PROGRAM
WRITE LINK DATA FILE ON DISK (LOGICAL UNIT NO. = TFILE1)
DISTRIBUTE SECONDARY TRAFFIC AMONG GRID SQUARES
IS DIFFUSION MODEL TO BE USED ?
NO
YES
CALL EMISSIONS MODULE TO CALCULATE AND PRINT GRIDDED EMISSIONS
CALL DIFFUSION MODULE, WHICH IN TURN CALLS EMISSIONS MODULE, READS METEOROLOGICAL DATA, CALCULATES AND PRINTS RESULTS
END

(a) EMISSION FACTOR PREPROCESSOR

(b) EMISSION RATE AND DIFFUSION MODULES (MAIN PROGRAM)

Figure 1. Simplified flow chart of MOBILE1/APRAC-3 modeling package.

Since the completion of APRAC-2, the EPA has again modified the methodology for the computation of mobile source emission factors. In fact, the new methodology is sufficiently complicated as to require creation of a computer code (MOBILE1) to perform the computations. With the present version of the model, APRAC-3, a new direction has been taken regarding emission computations. Because of the numerous revisions to the emission factor computation methodology that have been and probably will continue to be issued by the EPA, the emission factor computation process has been separated from the remainder of the model. The emission factor computation module, PREMOD, consists of a "driver" program and MOBILE1. The driver calls MOBILE1 to produce the table of emission factors required by APRAC-3 and writes the factors in a file. Thus, the incorporation of changes in the emissions methodology (future updates) will not require modification of the main program (the emission rate and diffusion modules). Although the driver may require some modification, it is likely to be minimal.

This program closely follows the method for computing emission factors that has been described in detail in Mobile Source Emission Factors (1978). Six types of vehicles are considered:

(1) Light-duty vehicles (LDV)

(2) Light-duty trucks (0-6000 lb gross vehicle weight) (LDT1)

(3) Light-duty trucks (6001-8500 lb gross vehicle weight) (LDT2)

(4) Heavy-duty gasoline-powered trucks (HDG)

(5) Heavy-duty diesel-powered trucks (HDD)

(6) Motorcycles (MC)

Emission factors are determined for each of these categories and then a weighted composite is formed based on the fractions of the total vehicle miles traveled (VMT) by the vehicles in different categories.

The composite emission factors for LDV are determined from:

$$E_{npstwx} = \mathrm{SUM}\ (C_{ipn} * M_{in} * R_{ipstwx} * A_{ip} * L_{p}\ U_{ipw} * H_{ip}) \qquad (1)$$

where

SUM( ) = summation over model year (i), from the calendar year for which emission factors are being calculated (i + n) to the calendar year 19 years previous (i + n - 19),

E_{npstwx} = composite emission factor in gm/mi for calendar year, n; pollutant, p; average speed, s; ambient temperature, t; fraction cold operation, w; and fraction hot-start operation, x,

C_{ipn} = FTP (1975 Federal Test Procedure) mean emission factor for the i^{th} model year light-duty vehicles during calendar year, n, and for pollutant, p,

M_{in} = fraction of annual travel by the i^{th} model year LDVs during calendar year, n,

R_{ipstwx} = temperature, speed, and hot/cold correction factor for the i^{th} model year LDVs for pollutant, p; average speed, s; ambient temperature, t; fraction cold operation, w; and fraction hot-start operation, x,

A_{ip} = air conditioning correction factor for the i^{th} model year LDVs for pollutant, p,

L_p = vehicle load correction factor for pollutant p,

U_{ipw} = trailer towing correction factor for the i^{th} model year LDVs for pollutant, p, and for fraction of cold operation, w,

H_{ip} = humidity correction factor for the i^{th} model year LDVs for pollutant, p.

The composite emission factor for light-duty trucks is given by an equation similar to the LDV expression, but without a trailer towing correction factor. Heavy-duty truck emission factors have a similar functional form, but no correction is made for temperature, cold starts, air conditioning, trailer towing, or humidity. Motorcycle emission factors are corrected for speed, temperature, and cold starts only. The user is referred to Mobile Source Emission Factors (1978) for the values and functional form of the non-LDV factors.

The model has internal provisions for estimating the percentages of catalyst and noncatalyst vehicles operating in cold, hot-transient, and hot-stabilized modes. It is assumed that the percentages vary with time of day and from one part of the city to another. Because reliable values for the percentages are not available, we have been forced to use the estimates shown in Table 1. Those vehicles not in the cold or hot-transient categories are assumed to be in the hot-stabilized group, and the number

Table 1

ASSUMED PERCENTAGES OF COLD AND HOT-TRANSIENT VEHICLE OPERATION

Time Interval (Local Time)	Engine State	Locale					
		Downtown (%)		Suburban Commercial (%)		Residential and Other (%)	
		Catalyst	Noncatalyst	Catalyst	Noncatalyst	Catalyst	Noncatalyst
1800 - 0700	Cold	30	20	15	10	60	50
	Hot Transient	10	20	10	15	0	10
0700 - 0900	Cold	10	10	10	10	80	80
	Hot Transient	0	0	0	0	0	0
0900 - 1600	Cold	20	10	30	20	30	20
	Hot Transient	30	40	10	20	30	40
1600 - 1800	Cold	50	50	30	30	20	20
	Hot Transient	20	20	10	10	10	10

of hot-stabilized catalyst and noncatalysts vehicles are assumed to be equal. When better estimates become available, the user should change the values given in the data statements in the driver program. The emissions are sensitive to these factors, so that the user should employ the best information available for his area.

The emission rates for each specific hour are calculated in PREMOD for each of 20 speeds (3-mph increments). Different sets of values are obtained for freeway and nonfreeway streets to reflect differences in vehicle mix. The three different kinds of city locations shown in Table 1 are also accounted for. Thus, for each pollutant, 120 values of emission rate are generated (20 speeds X 3 locations X 2 road types).

A new set of emission rates is calculated every hour to account for changing conditions. PREMOD will compute CO, HC, AND NO_x emission factors for any of three types of locations: low altitude, non-California; low altitude, California; and high altitude. Evaporative and crankcase HC emission factors are computed in addition to exhaust emissions. The year of interest may be any year from 1970 through 1995. The program allows the user to input vehicle registration and/or annual mileage accumulation rate by model year for each vehicle type, or to use default values consisting of national averages. The percentage mix of light-duty vehicles, light-duty trucks, heavy-duty gasoline trucks, heavy-duty diesel trucks, and motorcycles for two facility types, freeway or nonfreeway, may also be input, or the national average default values may be used. Other program inputs include ambient temperature, time of day, whether inspection maintenance is in effect in the modeled region, and, if the intersection submodel is to be used, the locale type of the intersection.

C. Emissions Module (EMOD)

The emissions module has three major functions. They are:

(1) To determine emissions on each primary traffic link.

(2) To determine the emissions from primary traffic links within each grid square.

(3) To determine the emissions from secondary traffic links within each grid square.

Primary traffic is considered to be all traffic that occurs on streets included in the input traffic data file. Secondary traffic is traffic that is on (generally) smaller streets not included in the file.

The EMOD can be used by itself to provide gridded inventories of emissions based on traffic data. Such outputs by themselves will be valuable representations of conditions in an area, or they can serve as inputs to models that use such gridded inventories. When the diffusion module is used, the gridded emissions and the emissions for each traffic link are both used in the calculations.

1. Apportionment of Primary Traffic Emissions to Grid Squares

The table of emission factors generated by the emission factor preprocessing module is used to determine the hourly emissions from each link in the primary data file. The emission rates are generated in terms of grams/vehicle-mile (gpm). Inputs for each traffic link can be entered either as total average weekday volume or as the volume for the hour modeled. In the latter case, the product of emission rate, hourly volume, and length of the link gives the total emissions from that link during the hour.

If the average daily traffic is given, then the portion occurring during the hour of interest must be determined. The diurnal distributions of traffic for the particular road type and section of the city are input to the model so that this correction can be made. A seasonal correction is also input. For these calculations, the model is capable of treating combinations of two different facility types (freeway and nonfreeway) and five combinations of land use and urban region. These combinations of land use and location are referred to as "locales." They are:

(1) Central business district (CBD).

(2) Commercial areas in the core of the city, or suburban centers.

(3) Residential areas.

(4) Industrial areas.

(5) Rural and miscellaneous.

Facility type (freeway or nonfreeway) must be identified for each link. The Federal Highway Administration records usually contain an area-type indicator and have provisions for including a land-use index. The model combines these into the five categories of "locale" enumerated above. The area types are (1) CBD, (2) core city, (3) suburban, and (4) other. The six land use categories that are considered are (1) commercial,

(2) residential, (3) industrial, (4) rural, (5) open space, and (6) other. Table 2 shows the locale category that is assigned to the various combinations of land use and area type.

Table 2

LOCALE INDEX FOR VARIOUS
COMBINATIONS OF AREA AND LAND USE TYPE

Land Use Type	Area Type			
	1	2	3	4
1	1	2	2	5
2	3	3	3	3
3	4	4	4	4
4	5	5	5	5
5	5	5	5	5
6	5	5	5	5

If land use categories are not specified, the model assumes that all CBD area types correspond to the same locale type. Core city areas are assumed to be commercial. Suburban streets are assumed to be commercial if their average weekday traffic exceeds 10,000; otherwise the locale is taken to be residential. The locale for areas that do not fit specific categories is taken to be rural, or unclassified. The speed information necessary to calculate the emissions for each link are either input or calculated from the capacity restraint relations.

After the total emissions for each link are known, the emissions are apportioned to the grid squares. Apportionment is done by assuming that the emissions are uniformly distributed along a straight line. The fraction of the line segment that falls within a given grid square determines the fraction of the total emissions for the link that fall in that square. The contributions of each link are summed for each square.

2. Apportionment of Secondary Traffic Emissions to Grid Squares

Two options are available for assigning secondary traffic to grid squares. The first uses the same method as APRAC-1A. Total secondary traffic for the area is specified as a percentage of the total traffic accounted for by the primary traffic file. The fraction of each grid square that is occupied by streets not in the primary file is also entered. The total area in the region that is occupied by secondary streets can be determined in arbitrary units from this information. The total secondary traffic emissions are calculated and then allotted to the grid squares according to the fraction of the area of each square that is occupied by secondary streets.

The other approach assumes that the ratio of secondary traffic to primary traffic varies by locale (or by land use). For instance, virtually all the streets in the CBD are likely to be important enough to be included in the primary traffic file. Similarly, very little traffic in rural areas is likely to be found off the major roadways. In residential and industrial areas, a large fraction of the total traffic may use secondary streets. The user should estimate the relative amounts of secondary traffic and primary traffic in the different locales. Only the relative values of this ratio from locale to locale need to be realistic; absolute values are not critical. The total average of daily VMT in the area is also input. The emissions from the number of miles traveled in excess of those in the primary network are allotted to the squares in which the primary links fall. The amount allotted to each square from a given link is proportional to the weighting factor assigned to the locale of that link

D. Diffusion Module (DIFMOD)

The diffusion module has four major functions:

- Calculate diffusion.
- Provide the necessary meteorological information.

- Account for special-source conditions near the receptor.
- Organize and process the large files of traffic data.

The model provides certain options: Meteorological information can be processed to provide mixing depths, or the mixing depths can be read in directly. Diffusion calculations can be made for as many as 625 locations for a single hour or as many as 10 locations for a single day. Either airport or local wind inputs may be used. Special submodels are available to treat emissions in a street canyon or in the vicinity of an intersection. If the intersection submodel is invoked, no more than 8 hours may be run.

1. Diffusion Calculations

The diffusion calculations use a number of area segments spaced at logarithmic upwind-range intervals from a receptor point, as shown in Figure 2. These area segments are oriented to the direction of the transport wind as shown in Figure 2. They overlap the traffic network. The traffic links and portions of links falling within each area segment are identified, and the emissions from the individual links are accumulated to determine the average emission rate for each of the nine segments. Emissions are assumed to be released uniformly over the entire area of the segment. To save computer time, the emissions within the four segments that are more than 2 km from the receptor are calculated from the gridded emissions (from the emissions module) using a technique described by Ludwig et al., (1970). The contribution of each of the nine upwind segments to the total concentration is computed individually. The individual contributions are then summed.

A Gaussian-plume diffusion formulation is used for the calculations. The vertical concentration profile from a crosswind line source (such as a road) is assumed to be Gaussian in shape, as shown schematically in Figure 3. The spread of this vertical concentration distribution is characterized by its standard deviation, σ_z, which can be approximated by an expression of the form

$$\sigma_z = ax^b , \qquad (2)$$

where x is distance from the receptor and a and b are parameters that depend on the atmospheric stability (see Johnson et al., 1971, Section V-D). The contributions from one of the upwind area sources to the concentration, C, at the receptor are then given by

$$\left(\frac{C}{Q_A}\right)_{ij} = \frac{0.8}{ua_{ij}} \left(1 - b_{ij}\right)^{-1} \left(x_{i+1}^{1-b_{ij}} - x_i^{1-b_{ij}}\right) , \qquad (3)$$

where Q_A is the average area emission rate (grams per square meter per second, or g $m^{-2}s^{-1}$) from the segment, and u is the transport wind speed. The subscript i denotes the different segments; x_{i+1} is the distance to the far edge, and x_i the distance to the near edge of segment i. The subscript j denotes different stability classes. The model is so formulated that the values of a and b need not be the same for all segments. However, the values currently used in the computer program (subroutine CALXOQ) do not vary with segment, but are functions only of stability class, j, as suggested by urban tracer experiments (Johnson et al., 1971).

A simple box model,

$$\left(\frac{C}{Q_A}\right)_i = \frac{x_{i+1} - x_i}{uh} , \qquad (4)$$

is applied for distant segments when there is a limiting mixing depth h, determined by the vertical temperature stratification. Under these conditions, pollutants tend to be distributed uniformly in the vertical after sufficient travel has taken place. A change from the Gaussian-plume model to the box model is made at the distance where the two equations would, if applied to a line source, give equal values of concentration. The distance, x_t, where the transition between Gaussian-plume and box models occurs is given by

$$x_t = (0.8h/a_{ij})^{1/b_{ij}} . \qquad (5)$$

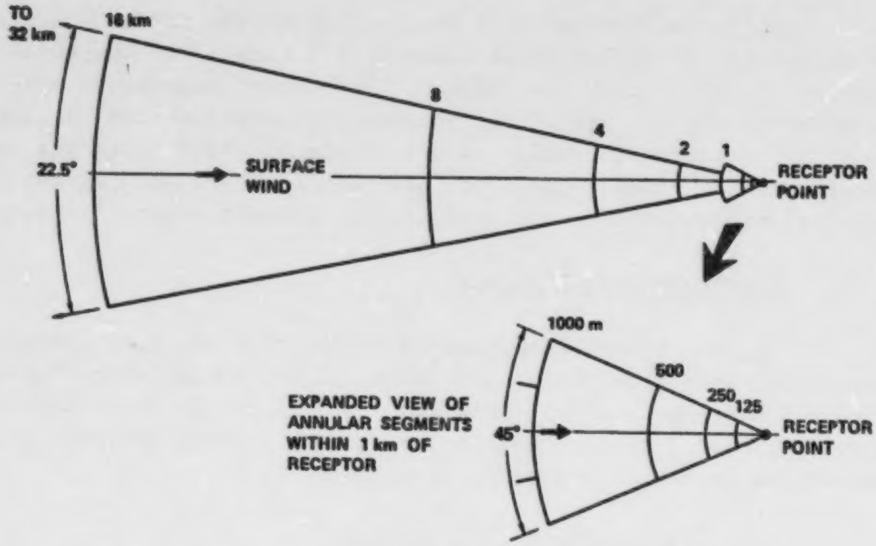

TO
32 km
16 km
8
4
2
1
22.5°
SURFACE
WIND
RECEPTOR
POINT
1000 m
500
250
125
EXPANDED VIEW OF
ANNULAR SEGMENTS
WITHIN 1 km OF
RECEPTOR
45°
RECEPTOR
POINT

Figure 2. Diagram of segments used for spatial partitioning of emissions.

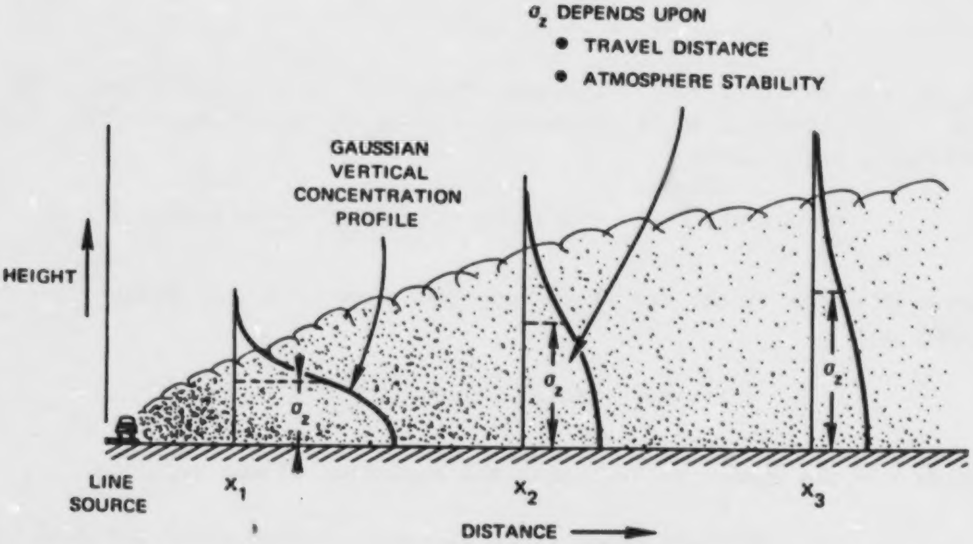

σ_z DEPENDS UPON
● TRAVEL DISTANCE
● ATMOSPHERE STABILITY
GAUSSIAN
VERTICAL
CONCENTRATION
PROFILE
HEIGHT
σ_z
σ_z
σ_z
LINE
SOURCE
x_1
x_2
x_3
DISTANCE

Figure 3. Vertical diffusion according to Gaussian plume formulation.

The contributions from sources beyond the farthest upwind segment were calculated in the original model with a simplified box model and estimates of upwind fuel consumption. Subsequent experience suggests that this approach was not realistic; because the contributions of distant sources are quite small, this feature of the original model has been deleted. In its place a provision has been made for reading the average concentration associated with each of 16 different upwind directions.

2. Meteorological Routines

The preceding discussion indicates that the model requires three types of meteorological inputs: mixing height, atmospheric stability, and winds. Of these parameters, only winds are routinely reported; thus, the model provides subroutines for processing routine meteorological observations to derive the other parameters.

a. Atmospheric Stability Class

The model uses a stability algorithm derived by Ludwig and Dabberdt (1976) from the basic method proposed by Pasquill (1961). Daytime stability categories are based on wind speed and the strength of the incoming solar radiation. The insolation strength, Φ (in arbitrary units) is estimated from the following equation:

$$\Phi = (1-0.5N) \sin \alpha, \qquad (6)$$

where N is the fraction of the sky covered by opaque clouds, and α is the solar elevation angle. Solar elevation can be estimated from the following expression:

$$\alpha = \arcsin \{ \sin \delta \sin \varphi + \cos [(\frac{H-12}{12})\pi] \cos \delta \cos \varphi \}, \qquad (7)$$

where H = hour of the day, local standard time (e.g., 11 rather than 1100) and

$$\delta = \arctan [-\tan(23.5^\circ) \cos (\frac{2\pi(n-10)}{365})] ,$$

where n = the number of days from the beginning of the year.

At night, wind speed and opaque cloud cover are used to determine atmospheric stability. When the sun is within 15° of the horizon, Class 4 (neutral) stability is presumed. Table 3 shows the relationship among wind speed, insolation, opaque cloud cover, and atmospheric stability used by the model.

Table 3

URBAN STABILITY CATEGORIES

Surface Winds (ms^{-1})	Daytime Solar Elevation Angle > 15°			Opaque Cloud Cover ≥ 0.9, Day or Night, or Solar Elevation Angle $\leq 15°$	Nighttime Cloud Cover	
	$\phi > 0.55$	$0.3 \leq \phi \leq 0.55$	$\phi \leq 0.55$		≥ 0.5	≤ 0.4
< 2	1	2	2	4	5	5
2-3	1	2	3	4	4	5
3-5	2	3	3	4	4	4
5-6	3	3	4	4	4	4
> 6	3	4	4	4	4	4

b. Mixing Height

Mixing height can be input directly to the model or calculated from radiosonde data[*], using the morning (1200 GMT) sounding from the nearest National Weather Service upper air station and the maximum daily surface temperature. The sounding and maximum temperature are used to calculate the maximum mixing height by the method of Miller and Holzworth (1967). It is assumed that at the time of maximum surface temperature the lapse rate in the lower atmosphere is adiabatic; i.e., the top of the mixing layer is at the height where the potential temperature on the morning sounding is equal to the afternoon surface maximum potential temperature. Potential temperature, θ, is defined as

$$\theta = T(1000/p)^{R/c_p} , \tag{8}$$

where:

T = temperature ($^\circ$K)

p = pressure (mb)

R/c_p = the ratio of the gas constant for air to its specific heat at constant pressure (0.287).

Potential temperature is calculated first for the surface maximum temperature and then for each of the successively higher reported radiosonde levels until the potential temperature at some level exceeds the surface maximum potential temperature. The pressure at which the maximum temperature and upper-level potential temperatures are equal is determined by linear interpolation between values for the reported levels. The thickness equation (e.g., Panofsky, 1957) is used to convert the pressure at the top of the layer, p_h, to height

$$h_{max} = \ln(p_o/p_h)(R\bar{T}/g) = 29.3\ \bar{T}\ \ln(p_o/p_h). \tag{9}$$

In this equation, g is the acceleration of gravity, p_o is the surface pressure, and $\bar{T}$ is the average of the temperature at the surface and the top of the mixing layer.

To estimate minimum mixing depth over the city for the synoptic model, we use Summers' (1966) model of the urban heat island and Ludwig's (1970) empirical relationship between rural lapse rates and the intensity of urban heat islands. An expression derived by Ludwig et al. (1970) is used to determine predawn values of urban mixing depths

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[*] For this model the pressures and temperatures at the significant levels should be used. (Deck 505, available from the National Weather Records Center, Asheville, North Carolina.)

$$h_{min} = \frac{29.3\ \bar{T}\ P^{1/4}\left(0.298\ \frac{dT}{dp} - 0.0633\right)}{\bar{p}\ \frac{dT}{dp} - 0.287\ \bar{T}} ,$$

where P is the population of the metropolitan area being studied.

The two methods described provide values of mixing depth for only two hours of the day: one predawn hour and the hour of the afternoon temperature maximum. The following interpolation equation is used from the first hour after sunrise through the first hour after sunset:

$$h = \left(\frac{T - T_{min}}{T_{max} - T_{min}}\right)\left(h_{max} - h_{min}\right) + h_{min} , \qquad (10)$$

where:

h = mixing depth

h_{max} and h_{min} = mixing depth at time of maximum temperature and at time of the morning sounding

T, T_{max}, T_{min} = current, maximum, and minimum temperature.

From the second hour after sunset through midnight, the mixing depth is interpolated by time. At midnight it has the value of h_{min} determined from the next morning's soundings. The early morning value of mixing depth is assumed to apply from midnight until the first hour past sunrise. The model assigns maximum and minimum mixing heights of 4000 m and 50 m, respectively, when these limits are exceeded by the computations.

Figure 4 is a schematic representation of the application of this temperature-time interpolation to a typical day's data.

c. Winds

If no other wind measurements are available, the model uses those from the nearest weather station and assumes that they apply throughout the area. However, if winds are available from several locations in the city (as many as 100 can be treated), the model can interpolate values of speed and direction for each receptor.

The interpolation scheme used in the model was derived from that used by Heffter and Taylor (1975). The interpolated wind at a location is given by

$$\vec{V} = \frac{\overset{R}{\Sigma} D_i A_i \vec{W}_i}{\overset{R}{\Sigma} D_i A_i} , \qquad (11)$$

where:

$\vec{V}$ = interpolated wind vector at the receptor

D_i = distance weighting factor for the ith wind observation

$= 1/r_i^2$

A_i = alignment weighting factor for the ith wind observation

$= 1-0.5 |\sin \theta_i|$

$\vec{W}_i$ = observed wind vector at the ith location

r_i = distance between the receptor and the ith wind observation point (see Figure 5)

θ_i = angle between $\vec{W}_i$ and the line segment connecting the receptor location and the wind observation point (see Figure 5)

$\overset{R}{\Sigma}$ = a summation over all wind observation points within a distance, R, of the receptor.

The summation radius, R, is taken as 10 km unless there are no wind observations within that distance, then R is increased to 20 km. Figure 5 illustrates the parameters used in wind interpolation.

When the wind speed is less than 1 ms^{-1}, that value is assigned as a minimum. When the Weather Service reports calm winds, and hence an undefined direction, the last reported direction is used, except that west winds are assigned if the first hour's wind is calm. With multiple wind inputs, the vector average direction for all reported winds is used if the interpolated value at a receptor is calm. If all reported winds are calm, then the last available areawide average direction is used.

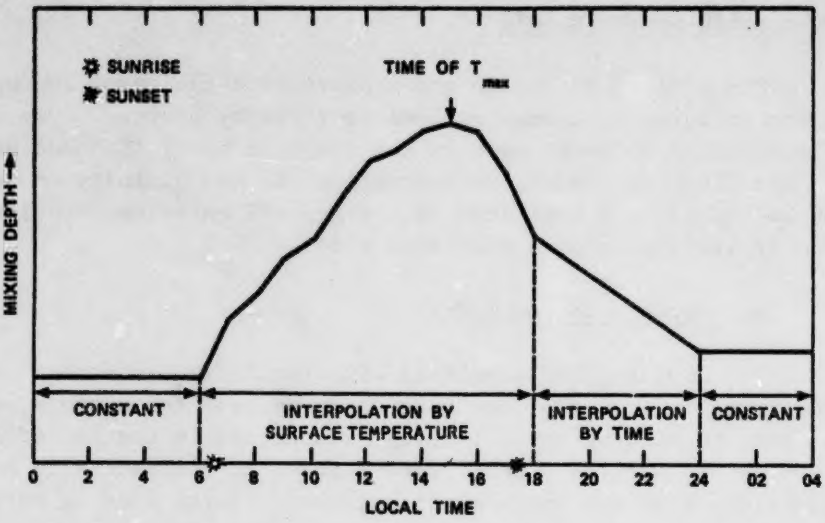
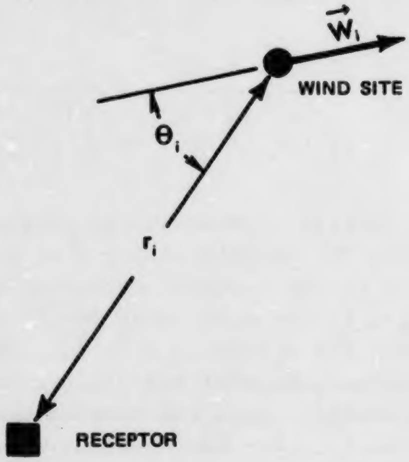


Figure 4. Schematic representation of the diurnal temperature/time interpolation of mixing depth.



$\vec{W}_i$
WIND SITE
θ_i
r_i
RECEPTOR

Figure 5. Parameters used in wind interpolation scheme.

3. Local Source Models

The APRAC-3 diffusion model provides a choice of two special models for calculating concentrations from nearby sources. One of these is the street canyon model used in the APRAC-1A model (Mancuso and Ludwig, 1972). The other determines concentrations in the vicinity of an intersection by combining a traffic model, a special emissions model and a detailed finite line source diffusion model.

a. Street Canyon Model

Evidence of a helical air circulation in street canyons, as illustrated in Figure 6, has been observed (see for example, Georgii et al., 1967 or Johnson et al., 1971). Receptors in the lee of a building (on the right in Figures 6 and 7) are exposed to substantially higher concentrations than are those on the windward (left) side of buildings because of the reverse flow component across the street, near the surface. Thus, the concentration at a receptor may be considered as having two superimposed components. One component is the concentration of the air entering the street canyon from above, C_b. (The concentration computed from sources beyond 125 m from the receptor represents C_b). The other component, ΔC, arises from the emissions generated within the street canyon. The equations used for calculating the street canyon components on both sides of the street were derived by Johnson et al. (1971) and modified by Ludwig et al. (1972). The concentration arising from street canyon emissions on the leeward side of buildings, ΔC_L, is given by

$$\Delta C_L = \frac{K\,Q_s}{(u + 0.5)\left[\left(x^2 + z^2\right)^{1/2} + L_o\right]} , \qquad (12)$$

K is an empirically derived nondimensional constant $\simeq 7$; L_o is a dimension representing the vehicle size $\simeq 2$ m; x and z are the horizontal and vertical distance of the receptor relative to the center of the traffic lane (see Figure 6); u is the wind speed (ms^{-1}); and Q_s is the average rate of emission along the street ($g\ m^{-1}s^{-1}$). Values of Q_s are computed from daily traffic volume, diurnal traffic cycles, and the vehicle emission rate at the average traffic speed and temperature. The windward sides of buildings along a street canyon have concentrations from the local street, ΔC_W, that are calculated by

$$\Delta C_W = \frac{K\,Q_s(H - z)}{W(u + 0.5)H} , \qquad (13)$$

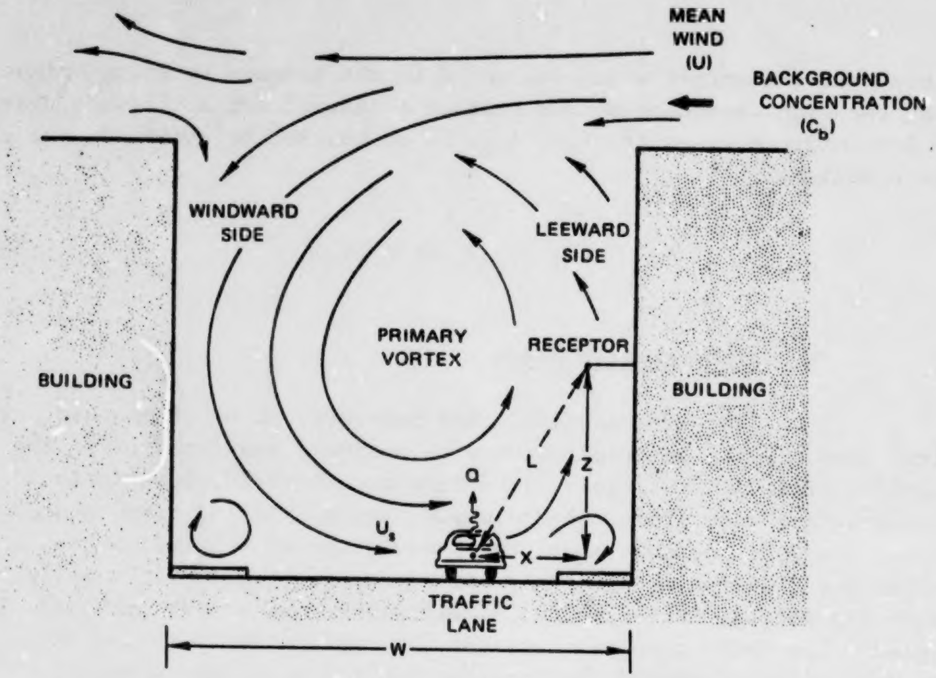
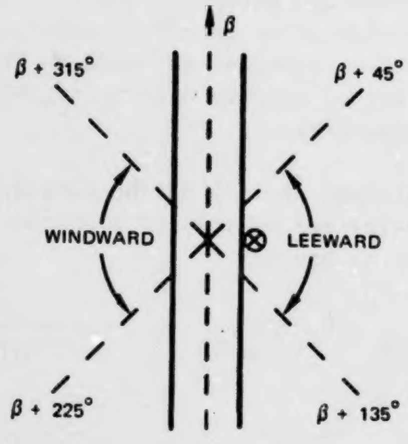

MEAN WIND (U)
BACKGROUND CONCENTRATION (C_b)
WINDWARD SIDE
LEEWARD SIDE
PRIMARY VORTEX
RECEPTOR
BUILDING
BUILDING
L
Z
Q
U_s
X
TRAFFIC LANE
W

Figure 6. Schematic of cross-street circulation between buildings.


β
β + 315°
β + 45°
WINDWARD
LEEWARD
β + 225°
β + 135°

SINGLE STREET

Figure 7. Specification for leeward and windward cases on the basis of receptor location, street orientation, and wind direction.

where W is the street width (m) and H is the average building height (m). When the wind direction allows neither a leeward nor a windward case, an intermediate concentration, ΔC_I, is calculated by combining the above two equations:

$$\Delta C_I = 1/2\left(\Delta C_L + \Delta C_W\right) \quad . \tag{14}$$

b. Intersection Model

The intersection model has three major components. The first uses traffic engineering data to estimate traffic flow in the vicinity of an intersection. It determines where accelerations and decelerations take place, queue length, average idling time, and so forth. A modal emissions model takes advantage of the information provided by the intersection model. This second component calculates emission rates for idling, acceleration, deceleration, and steady-speed driving cycles. The third component assigns the appropriate emission rates to the line segments around the intersection and then uses a numerical approximation to calculate the diffusion and the concentrations at the receptor.

The intersection traffic submodel (subroutine INSEC) is used to determine the average delay per vehicle, the number of vehicles that stop, and the average queue length on each approach to an intersection. The intersection submodel is based on Webster's (1958) work, and includes the ability to compute optimum signal timings, given cross-street volumes and capacities.

A simplified version of the Webster model is summarized below. The average delay per vehicle on a single intersection approach is given by the following equation:

$$D = \frac{C\ (1-\lambda)^2}{2\ (1-\lambda Q/S)} + \frac{Q}{2\ (S-Q)\lambda S} \tag{15}$$

where

D = average delay per vehicle

C = cycle time

λ = proportion of cycle which is effectively green for the phase under consideration

Q = flow

S = saturation flow.

Cycle time is computed by:

$$C = \frac{1.5\,L + 5}{1 - SY} \quad , \qquad (16)$$

where

SY = the sum of the controlling YT values for each phase

L = the lost time per cycle in seconds = (CI/2 + 3 + NP)

YT = the maximum volume to capacity ratio associated with any signal phase

NP = the number of signal phases for which a yellow indication is displayed.

The equation for phase length, PT, is:

$$PT = (YT \cdot C/SY) \quad . \qquad (17)$$

A flow diagram of the signalized intersection submodel (INSEC) is given in Appendix A. The method of calculation assumes a period of time during which traffic demand and signal timing remain constant, and provides an estimate of delay and queue length whether traffic demand is less than, or exceeds capacity during a time period.

An extension to the Webster model treats an intersection that is part of a coordinated signal system. In this extension, found in subroutine PLATON, vehicle traffic demand is divided into two possible flow rates on a cyclic basis. The relative arrival time of each platoon of vehicles, plus the size of an average platoon, are specified by the user.

- The platoon arrives and terminates during the red phase.

- The platoon arrives during red, transits green, and terminates during red.

The platoon size and relative arrival time may be defined by the user on the input cards. Platoon size is defined by specifying a percentage of the total arrivals. If no percentage is specified, the program computes a value from the ratio of through vehicles at the upstream intersection to the total vehicles that turn into the approach at the upstream intersection.

The relative arrival time of the platoon must be specified by the user if the effects of platooning are to be taken into account. Here the user determines, in relation to the start of the green phase, the time when the platoon arrives at the intersection. A negative time indicates that the platoon arrives before the start of the green cycle, and a positive time indicates that the platoon arrives after the start of the green phase.

The platoon submodel provides average vehicle delay because of the gating effect of the signal and the maximum number of vehicles that come to a stop during a signal cycle.

A modal emissions model contained in the subroutine MODMOD takes full advantage of the detailed information provided by the intersection and platooning traffic models. In other parts of the APRAC model, emissions are estimated by the Federal Test Procedure (FTP) method, which assumes typical driving cycles and uniform emissions over a complete section of roadway or traffic link. This is an adequate treatment for emissions from the more distant sources where diffusion has had time to obliterate the fine-scale features of the original emission patterns, but it is sometimes desirable to treat the fine-scale features of nearby sources. The extent of the variability is summarized in Table 4. The rates in Table 4 are solely illustrative, presented only to show the variability of emissions and the importance of idling vehicles.

Table 4

TYPICAL CARBON MONOXIDE EMISSION RATES DURING DIFFERENT PARTS OF A DRIVING CYCLE

(Calendar year 1980, warmed-up, light-duty
vehicles at low altitude, average speed of 20 mph)

Type of Driving	Emission Rate (grams per vehicle per meter)
Steady speed	0.016
Decelerating	0.017
Accelerating	0.059
Federal Test Procedure Cycle	0.026

Subroutine EMITX calculates average vehicle emissions at different points along each link connected to a signalized intersection. The Kunselman (1974) modal emissions model is used to predict emissions from vehicles accelerating, cruising, decelerating, and idling. The delay, queue length, and number of stops from the intersection model are used to define the segments of each link where different modal emission rates occur and the number of vehicles involved. Emission rates are calculated for the calendar year mix of light-duty vehicles being modeled and then corrected for temperature, percent cold starts, and the number of heavy-duty vehicles.

The Kunselman (1974) modal emissions model determines an instantaneous emission rate, $\dot{e}(t)$, that is a function of vehicle speed and acceleration. Acceleration to or from a given speed is assumed to be a perturbation to the steady-state emission rate, and two equations are used to describe the emission rate:

$$\dot{e}(v,a) = b_1 + b_2v + b_3a + b_4av + b_5v^2 + b_6a^2 + b_7av^2 + b_8a^2v + b_9a^2v^2 \qquad (18)$$

and

$$\dot{e}(v,o) = b_{10} + b_{11} v + b_{12}v^2, \tag{19}$$

where Eq. (18) describes the nonzero acceleration emission rate and Eq. (19) describes emission rates for steady-speed driving. The coefficients b_1 through b_{12} are provided for each of 18 different vehicle groups.

The modal emissions model has been modified for use in APRAC-3. Details of the modifications and instructions for including further updates to the emissions methodology are presented in Appendix B.

Lineal emission rates (gm s^{-1}) are calculated for five sections of each link leading to or from the intersection being modeled. The length and location of each section and the type of modal emissions associated with it are defined as follows:

Section 1 = The section of the link in which vehicles accelerate from a stop.

Section 2 = The section of the link where vehicles move at a steady speed, i.e., are in the cruise mode.

Section 3 = The section of the link where stopping vehicles decelerate.

Section 4 = The upstream half of the maximum queue extension, in which stopping vehicles decelerate, idle, and accelerate.

Section 5 = Half the maximum queue extension measured from the intersection stop line, in which stopping vehicles idle, accelerate, and decelerate.

It should be noted that cruise mode emissions from vehicles that do not stop at the intersection occur in all five sections. Thus, the emissions from any section are always the sum of the emissions from steady-state vehicles (if any) and stopping vehicles (if any).

The basic considerations in determining delay at a signalized intersection were well defined in a paper by Sagi and Campbell (1969). Their concept disregards the discrete nature of cars and considers traffic as a continuous fluid that arrives at a uniform rate q, is dammed for a time R, and then released at a rate, s, until the dam is empty. Thereafter it leaves at the arrival rate provided the green time is long enough. Figure 8 shows schematically the form of such a model where QUEUE is the queue; R is the red phase length; G is the green phase length; Cy is the cycle length; and the total delays for all vehicles during any time interval is the area under the curve between the limits of the time interval.

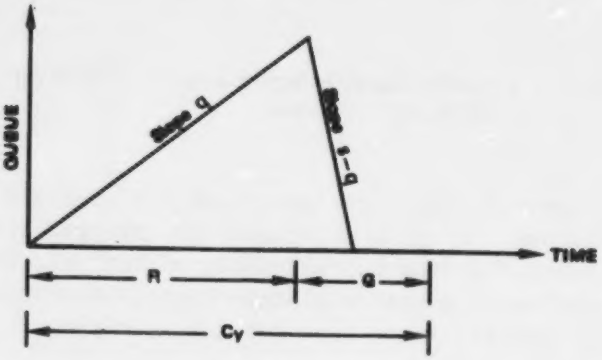


Figure 8. Schematic diagram of a model of queue behavior at a signal with platooned vehicle arrivals.

In a coordinated signal system, "platoons" of vehicles are periodically released from the upstream signal and arrive at the downstream intersection at a calculable time during the signal cycle. Figure 9 depicts the model of queue length and delay at the downstream intersection. In Figure 9, q_2 is the arrival rate of the platoon, t_2 is the time duration of the platooned arrivals, and q_1 is the arrival rate of the remainder of the arriving vehicles.

The area under the curve will vary depending on t_o, the relative arrival time of the platoon, and t_2q_2, the number of vehicles that arrive in a platoon. The value for t_o has been expressed relative to the start of the green phase; thus in Figure 9, t_o would have a negative value, because it represents a time which is less than the green phase starting time.

The intersection model computer program calculates the

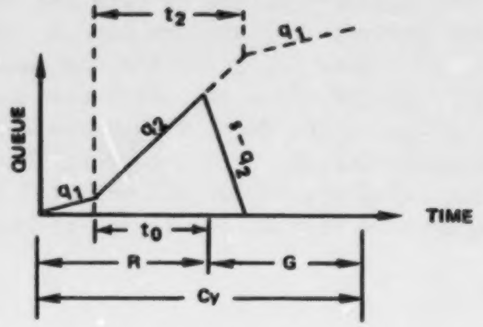


Figure 9. Schematic diagram of basic description of queue behavior at a signalized intersection.

area under the curve during a red phase and the area under the curve during a green phase. It then determines the average delay by summing these two areas and dividing by the number of arrivals during a signal cycle. There are three possible platoon arrival-termination patterns for which unique equations are required for computing the average delay:

- The platoon arrives and terminates during the green phase.
- The platoon arrives during green and terminates during red.
- The platoon arrives during red and terminates during green.

An example of an emissions profile is presented in Figure 10. The profile represents the vehicle emissions in each section of the total traffic link. Of all emissions from idling vehicles, 75% are assigned to the half of the queue nearest the stop line and 25% to the upstream half of the queue. This approximates the effects from early arrivals in the queue that idle for longer periods than the later arrivals. A uniform vehicle arrival rate is assumed, so vehicles that stop in the downstream half of the queue will idle three times as long, on average, as vehicles arriving in the upstream half of the queue.

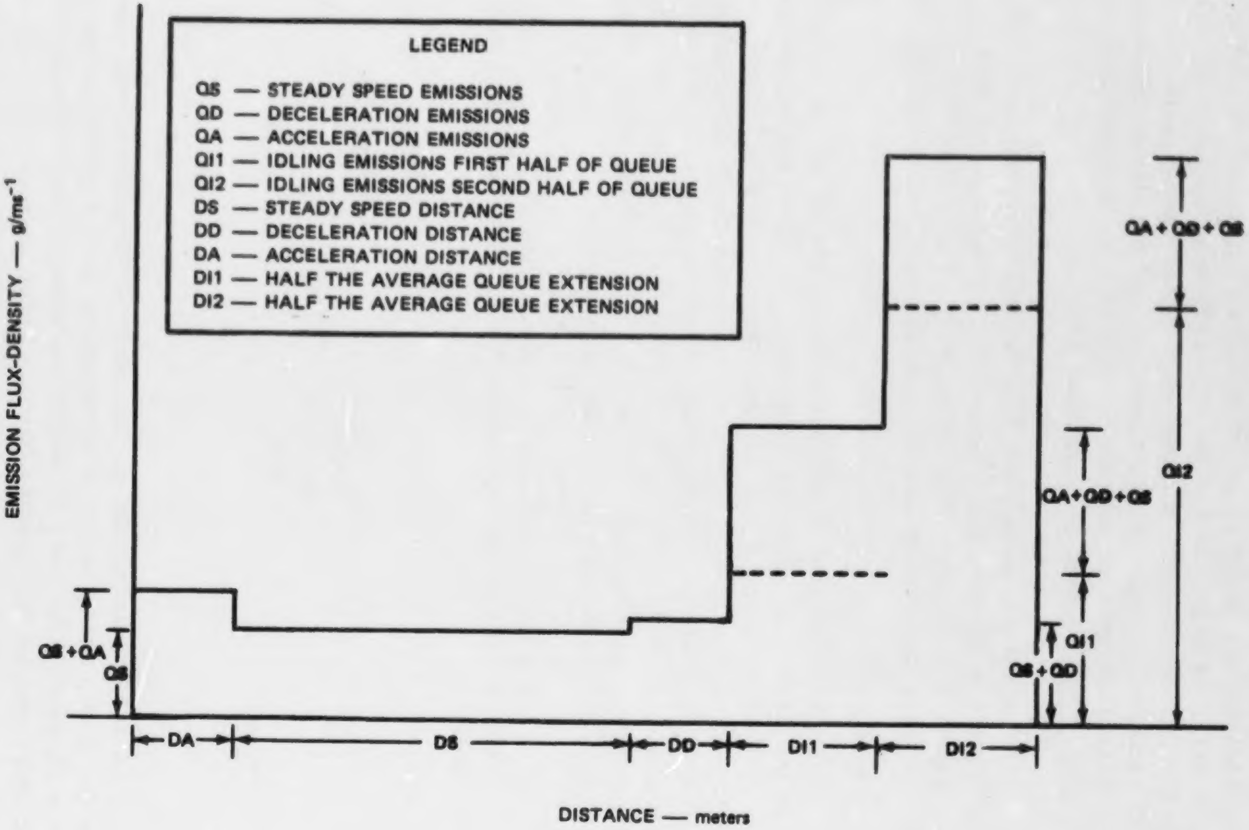

LEGEND
QS — STEADY SPEED EMISSIONS
QD — DECELERATION EMISSIONS
QA — ACCELERATION EMISSIONS
QI1 — IDLING EMISSIONS FIRST HALF OF QUEUE
QI2 — IDLING EMISSIONS SECOND HALF OF QUEUE
DS — STEADY SPEED DISTANCE
DD — DECELERATION DISTANCE
DA — ACCELERATION DISTANCE
DI1 — HALF THE AVERAGE QUEUE EXTENSION
DI2 — HALF THE AVERAGE QUEUE EXTENSION
EMISSION FLUX-DENSITY — g/ms⁻¹
QS + QA
QS
QS + QD
QI1
QA + QD + QS
QI2
QA + QD + QS
DA
DS
DD
DI1
DI2
DISTANCE — meters

Figure 10. Example of emissions profile.

A numerical example illustrates the above concept. Suppose 10 vehicles stop in a queue, the first vehicle waits 19 seconds, the second 17 seconds, the third 15 seconds and so on, before starting off again. The total idling time for the first five arrivals is 19 + 17 + 15 + 13 + 11 = 75 seconds and for the second five arrivals is 9 + 7 + 5 + 3 + 1 = 25 seconds. Similarly, accelerating and decelerating vehicles contribute emissions to each section of the link in proportion to the length of time spent in each mode on that section.

Emissions calculated for the calendar year mix of vehicles being modeled are corrected for temperature, percentage of cold-starting vehicles, and number of heavy-duty vehicles. Temperature/cold start and heavy-duty vehicle correction factors are computed using the EPA MOBILE1 model.

The line-source diffusion calculations are performed in the subroutine LINE. The methods used here are patterned after those described by Sandys, Buder (Simmon), and Dabberdt (1975). Very briefly, the emissions from the finite line sources around the intersection are approximated by emissions from an array of point sources. The smaller the spacing between these points, the better they represent the line source. However, the computer time required to compute concentration in this manner increases as the spacing decreases.

The model determines a spacing that will limit errors resulting from the finite spacing of points to 5%. The 5% variability is defined thus.

$$\frac{\chi_{ref} - \chi}{\chi_{ref}} = 0.05, \qquad (20)$$

where χ_{ref} is the concentration at the receptor resulting from some reference point on the link, and χ is the concentration from a point on the link at a distance ΔL away. The case in which the wind is perpendicular to the link is the most sensitive to the spacing between point sources (ΔL). Assuming the reference point to be on the centerline of a Gaussian plume with a cross-wind standard deviation of σ_y at the receptor, it can be shown that the value of ΔL that satisfies the above criteria is given by:

$$\Delta L = \sqrt{-2\ln(0.95)\sigma_y^2} \quad . \tag{21}$$

To be conservative, the routine uses a spacing equal to one-half of the value of ΔL defined by the above expression.

The emission rate used for each point source is determined by the section of the link in which it falls. The emission rate is the rate calculated for that section of the link in subroutine EMIT, multiplied by the spacing between the point sources. The equation for the concentration from each point source is:

$$\chi_p = \frac{Q_p}{\pi\sigma_y(d_w)\sigma_z(d_w)u} \exp\left\{-\frac{d_c^2}{2\sigma_y^2(d_w)}\right\} \exp\left\{-\frac{H^2}{2\sigma_z^2(d_w)}\right\} \tag{22}$$

and

$$\sigma_y(d_w) = a\,(d_w)^b + c \tag{22}$$

$$\sigma_z(d_w) = f\,(d_w)^g + h \quad , \tag{23}$$

where

χ_p = the CO concentration, gm m^{-3}

u = the wind speed, m sec^{-1}

Q_p = the point-source emission rate, gm sec^{-1}

$\sigma_z(d_w)$ = the lateral standard deviation of plume concentration at distance d_w, in meters, m

$\sigma_z(d_w)$ = the vertical standard deviation of plume concentration at distance d_w, in meters, m

H = the emission height, m

d_c = the crosswind distance from point source to receptor, m

d_w = the distance along wind direction from point source to receptor, m a,b,f,g = the diffusion coefficients and exponents, depending on atmospheric stability

c,h = the constants representing initial diffusion, m.

A coordinate transformation of the link endpoints and the receptor is required to allow the same point-source equation formulation to apply to all receptor-link configurations. The crosswind and upwind distances are then found. Initial horizontal diffusion is determined by the spacing of point sources, but is not allowed to exceed the half-width of the roadway. Wind speed is provided from the airport wind or the wind interpolation routine. Emission height and initial vertical diffusion are input by the user.

The contribution from each point source on the link to the concentration at a receptor is calculated. The individual contributions are then summed to determine the overall effect from the traffic links feeding into the intersection. A flowchart for subroutine LINE is included in Appendix A.

Proper calculation of the line source emissions requires that the traffic links attached to the intersection be identified in the total traffic file. The identification is performed by subroutine PICKIT. The characteristics of the links, as defined in the main traffic file, are then used as input to the intersection calculations.

The intersection model treats different pollutants differently. When calculating CO concentrations, the entire contribution from the intersection is determined by the intersection model. The emissions from the intersection links are not included in other parts of the calculations. Only the exhaust emissions are included in the intersection calculations of HC emissions. Evaporative and crankcase HC emissions are distributed uniformly along the links and treated elsewhere in the calculations. The intersection model does not treat NO_x emissions because their dependence on different modes of vehicle operation are poorly defined.

4. Reorganization of the Traffic File

In creating APRAC-2 from APRAC-1A, one of the major modifications was to include a capability for treating an essentially infinite number of traffic links. The number of traffic links contained in some of the larger data files available from the Federal Highway Administration (FHWA) would tax the capacities of all but the largest computers. Therefore, APRAC-2 had to be designed so that all of the traffic file need not reside in core memory at any given time. To help meet that requirement, diffusion calculations within APRAC-2 used emission rates derived from grid-square values at distances greater than 2-km from the receptor. The traffic link data were required only within 2-km, so the traffic file was stored on disk and link information was transferred to core storage as needed.

This arrangement, while a practical solution to the problem of how to handle a large number of links, has one major drawback: the large number of input/output operations required to transfer information between core and disk entail considerable expense. To mitigate this problem in APRAC-3, an optional traffic file reduction capability as been added. If the option is exercised by the user, the program will keep the highest volume traffic links in core at all times and treat lower volume links as secondary traffic. If the number of traffic links and the Vehicle Miles Traveled (VMT) distribution on the links is such that the user feels too much information would be lost in using the file reduction option, the program can still operate in the APRAC-2 manner.

If the file reduction option is not exercised, the program creates a geographic file to locate those traffic links near the receptor. This is done with the subroutine REFILE. Subroutine REFILE goes through the traffic link file and determines in which 3-km square the midpoint of the link falls. The numbers of links whose midpoints fall in each square is also recorded. A new, random access file is then written such that all links whose midpoints fall in the same grid square follow one another in the new list of link information. The address of the record containing data for the first link listed for each grid square is retained so that all the link information for any square can be found easily when needed.

The geographic traffic file is used to create an emissions file. This file has one record for each grid square. Each record contains the endpoint coordinates and the total emissions of the pollutant being modeled for every link in the square. The program uses record sizes that can accommodate as many as 506 links per square, which should be adequate for almost any eventuality. This corresponds to a square filled with links that are about 190-m long and spaced about 190-m apart. Such a density of links seems unlikely to be exceeded.

When the diffusion calculations are to be made for a particular receptor, traffic link emissions are read from the sorted emissions file for all those links whose midpoints fall in the same grid square as the receptor, or in any of eight surrounding squares. The model currently uses array dimensions such that the information from as many at 1500 links within this 9-km by 9-km area can be treated. Inasmuch as APRAC-1A required only 1200 links for entire cities, this number should be sufficient for the small area surrounding a receptor. In any event, the dimensions can easily be changed.

If the traffic file reduction option is to be employed, subroutine BIGLNK is called. BIGLNK identifies the links having the largest VMT and stores the relevant information on those links in core memory where it is used in subsequent calculations. The traffic volumes on the remaining links are distributed as secondary traffic among the appropriate grid squares.

The user may specify either a minimum VMT for which links are to be retained in the file or the number of links that should be retained. If the minimum VMT is specified and the number of links having VMT in excess of that value is greater than 1500, the program will stop and advise the user of that condition. The model must then be rerun either: (1) With a higher minimum VMT (2) Specifying the number of links to be retained rather than a minimum VMT (3) Without the link reduction option invoked.

If the number of links to be retained in the file is specified, the model will print the VMT value that it determined was the minimum that would cause retention of the desired number of links. The number of links retained may vary slightly from the number specified so that all links having a particular VMT value are either retained or included with secondary traffic. Finally, the user may flag certain links to insure their retention in the primary traffic file.

SECTION 3

INPUT REQUIREMENTS

A. Background

The APRAC-3/MOBILE1 programming package consists of an emission factor preprocessor, an emission rate module, and a dispersion module. Each of these programs has its own set of input data, although when the emission rate and dispersion modules are both to be used, their input data are combined to form one deck. In addition, there is a traffic file processing program, COMSIS, which may be used to convert FHWA traffic data to a format that can be read by APRAC-3. The input data requirements of each of these programs are described in the following sections.

The program has been written to provide some flexibility in data input. The logical unit numbers for inputs and outputs are defined at the beginning of both the preprocessor and the main program. For instance, if it is desired that weather data be input from a different unit than other data, appropriate changes can be made in the program. The program listed in the appendix reads all input data except FHWA-format traffic information and the emission factor tables from logical unit number five; unpacked FHWA traffic data are input from logical unit number two and the emission factors are read from logical unit number 8. Logical unit numbers 11, 12, 13, and 14 are used for intermediate files during the operation of the program. Logical unit 6 is used for system printer output.

The tables that describe the input requirements in the following sections give the name of the logical unit from which the program reads each input. This should help a user who desires to alter the program so that different types of data are read from different input units.

B. Program COMSIS

If FHWA traffic data are to be used, they must first be converted to a format compatible with the rest of the program. For IBM machines this is done with the program COMSIS. This program will read (from logical unit one) and unpack the data and create a file (logical unit two) for subsequent use by the APRAC-3 program.

Table 5

VARIABLE NAMES AND USE

Variable Name	(Default)	Use
AR	(18)	Location[*] of Area Type
FA	(16)	Location[*] of Facility Type
LAB	(46)	Location[*] of Number of Lanes A-B
LBA	(50)	Location[*] of Number of Lanes B-A
LU	(20)	Location[*] of Land Use
IVLWRD	(0)	Word number of first word of three-word volume group from which to extract the link volumes
IZONES	(0)	Number of highest centroid connector, if to be different from that found in historical record.
LABLNG	(82)	Length of shortest label record in beginning of historical record. The program will terminate if short label records are found.
MAXWRD	(IVLWRD+2)	Length of link records in words in the historical record data set. Only required if historical record is not standard.
NODES	(0,99999)	Two node values to specify if only links with both nodes within the range are to be processed.
XRANGE	(0,9999999)	Two x-coordinate values to specify if only links with both nodes within the range are to be processed.
YRANGE	(0,9999999)	Similar to XRANGE, but applies to y-coordinates.

[*] Location refers to the byte in the historical record; the first byte is designated as 1.

COMSIS begins by reading control cards from logical unit 5. The control cards are used to establish certain parameters for the program. There is one required card and one optional card. The first card is used as an identification for the run; the contents of columns 1-72 are listed on the printer unit, and columns 1-69 are listed as the first record on the output link file.

The second card is optional and read as a FORTRAN Namelist card, and as such follows all the rules for Namelist. The card must begin with the characters &PAR beginning in column 2 followed by a blank. The allowable variable and array names may follow in any order on as many cards as desired. Each variable is followed by an equals (=) sign and a value which is followed by a comma. The last item on the last card must be &END. Table 5 indicates what variable names are allowed and where they are used.

Normally, the variables AR, FA, LAB, LBA, and LU are contained in the historical record as alphanumeric characters. The variables must therefore be translated into a binary number for use as indices and computational values in the program. The recode tables provide the mechanism whereby this translation can take place. The tables also provide for the capability to recode input values to other values.

For example, suppose the historical record contained the values shown in Table 6 for facility type (FA).

Table 6

RECODE INFORMATION FOR TRAFFIC LINK DATA

Character	Internal Binary Value	Meaning	Desired FA
1	241	Divided arterial	2
2	242	Undivided arterial	2
3	243	CBD ramp	2
4	244	Non-CBD ramp	2
A	193	Four-lane freeway	1
B	194	Six+lane freeway	1

In this case, the user must specify that the FA values be recoded to values that are either 1 or 2, since those are the only acceptable values for FA in the program. To do this, the user would supply the following FCODE values on the &PAR card:

FCODE=256*2,FCODE(194)=1,1 or, FCODE=193*2,2*1,61*2

Note that all table locations are displaced by 1 to allow the value 0 to be the first entry. Although the alphanumeric values 0-9 are internal values 240-249, they would be recoded from the 241-250 values of the recode tables. Each of the recode tables is preset to recode all alphanumeric numbers to an equivalent binary number; any values out of range are set to a specified default. If the user revises the recode tables, he must be sure not to place any illegal values into the tables. For a further explanation on the use of table arrays on a Namelist control card, the user is directed to read any FORTRAN IV user manual where Namelist is explained. The recode tables may be specified as listed in Table 7.

Table 7

RECODE INFORMATION

Table	Recodes	Allowable Values	Default Values
ACODE	AR	1-4	241*4,1,2,3,12*4
FCODE	FA	1-2	214*2,1,14*2
LCODE	LU	1-6	241*6,1,2,3,4,5,10*6
NCODE	LAB,LBS	any	241*0,1,2,3,4,5,6,7,8*0

A CAPDEF table is used to obtain the directional hourly capacity on a link if the capacity is not in the historical record link data. In conjunction with CAPDEF, LAB and LBA are also required to multiply the capacity value by the number of lanes. The CAPDEF table is dimensioned (4,2) for 4 area types and 2 facility types, so the data are in 8 consecutive cells, the first 4 for the 4 area types for freeways (facility type 1) and the next 4 for the 4 area types for nonfreeways. The program set default values are:

```
CAPDEF=1850,1800,1800,1725,650,800,800,850.
```

The input for operation of the program for unpacking the FHWA data might be like the following example:

```
                THIS IS A HEADING (REQUIRED) CARD

     &PAR  AR=19,IVLWRD=22,LABLNG=86,NODES=1000,2000
           XRANGE=15700,17200,YRANGE=10000,12000
           ACODE(245)=2,CAPDEF(1,2)=675        &END
```

After the control cards are input, the program then proceeds to read the FHWA data. This binary historical record is a binary file of variable-length records and is rather complicated in structure. A complete description of the file can be found in "Urban Transportation Planning, General Information," U.S. Department of Transportation, Federal Highway Administration (March 1972). At the beginning of the file there are a number of user label records that describe the contents of the data records portion of the file. These labels, normally 86 bytes long, are copied from the historical record to the output link file. Sometimes some of these labels are less than 86 bytes; that is why the LABLNG parameter is available to the user. The program may terminate prematurely if it tries to read a record that is shorter than LABLNG.

The coded link file consists of 70 character records containing information about each link in the network. The file is maintained in alphanumeric code which is directly readable and printable by most computers. The first control card and all the user labels from the historical record are written at the beginning of the file. The file format is shown in Table 8.

The data records created at this point are read from the file later. The user does not need to supply another external input for IBM machines. The program COMSIS could be also used once with an IBM machine to provide a tape traffic file that could be used subsequently without modification on almost any machine.

C. Emission Factor Preprocessor

Whether the APRAC-3 emission rate module is to be run alone or in conjunction with the dispersion module, the emission factor preprocessor must be run first. The preprocessor has its own set of input data,

Table 8

LINK FILE FORMAT

Column	Contents
First record	
1	*
2-70	Columns 1-69 from first control card
Variable number of records	
1	*
2-70	Columns 1-69 from user labels on historical record
1	*
2-9	Blank
10-70	Remainder of user labels from historical record
Format record	
1-20	'*FORMATbFORbDATAbISb'
21-43	'(215,418,14,311,216,15)'
44-70	Blank
End of labels	
1-8	'DATAbbb'
9-70	Description of link data records
Data records	
1-5	Anode
6-10	Bnode
11-18	Anode x-coordinate
19-26	Anode y-coordinate
27-34	Bnode x-coordinate
35-42	Bnode y-coordinate
43-46	Link Length (xx.xx miles)
47	Land use (1-6)
48	Area type (1-4)
49	Facility type (1-2)
50-55	A-B daily volume
56-61	B-A daily volume
62-66	Nondirectional hourly capacity
67	Not used
68	Land use as found on historical record
69	Area as found on historical record
70	Facility as found on historical record

which is described below. The output it generates--tables of emission factors--are written onto disc files for use by the APRAC-3 emission rate module.

The input data requred to operate the emission factor preprocessor are listed in Table 9. The first four cards are flags that tell the model what options are to be exercised and what data will be supplied. The next card contains the calendar year for which computations are to be made, and the following card designates which pollutants are to be considered.

Card P-8 specifies the location of the intersection to be considered by the intersection model and is included only if QISMAP=YES. The next card specifies the number of hours for which computations are to be made and which is the first hour. Card P-10 contains the ambient air temperature for each hour to be modeled, while optional cards P-11 and P-12 contain model year mileage and registration distributions for each vehicle type. If P-11 and P-12 are omitted, national average distributions are used. (See Mobile Source Emission Factors, 1978.)

The fraction of travel by each type of vehicle on freeway and non-freeway streets may be entered on cards P-13 and P-14, or these cards may be omitted and the model will use national average values as a default. Finally, if inspection/maintenance is in effect in the area to be modeled (INSPEC was set to YES), several parameters describing the program must be input on Card P-15.

D. Emission Rate Module

Once the emission factor preprocessor has been run, the emission rate module may be run. The inputs required to operate EMOD are listed in Table 10. The first 17 cards are all required to identify which options are to be used during the run and the other parameters that define the nature of the run. The first 12 define options and require a yes or no specification, as explained in the table. The next card (No. E-13) provides an identifier for the area. This card is followed by two cards defining whether low-altitude or high-altitude emissions calculations were made by the preprocessor and whether California or non-California emissions controls applied.

A note should be made regarding card E-8. One of the inputs on card E-8 is a flag indicating whether the primary traffic file is to be reduced for computational efficiency. If the option is exercised, the user

Table 9

INPUTS FOR DRIVER PROGRAM

Input	Logical Units Name	Column	Format	Variable Name	Units	Value Limits	Typical Value	Description
P-1	IREAD	51-54	A4	QISMAP	--	YES or NO	YES	Indicates if special intersection model is used.
P-2	IREAD	51-54	A4	INSPEC	--	YES or NO	YES	Indicates if inspec/maint. program benefits to be included in emission factors. (Must be NO if QISMAP=Yes)
P-3	IREAD	51-54	A4	USRMYM	--	YES or NO	NO	Indicates if user supplies annual mileage rates.
	IREAD	61-64	A4	USRMYR	--	YES or NO	YES	Indicates if user supplies registration distributions.
P-4	IREAD	51-54	A4	USRMIX	--	YES or NO	YES	Indicates if user supplies VMT modal splits.
P-5	IREAD	51-54	A4	REGION	--	LOW/CAL/ HIGH	CAL	Specifies use of low-altitude, California, or high-altitude emission factors (LOW ≤ 4000 ft.).
P-6	IREAD	51-54	I4	CY	--	1970-1995	1983	Calendar year for emission calculations.
P-7	IREAD	51-54 61-64 71-74	A4 A4 A4	QPOL(1) QPOL(2) QPOL(3)	-- -- --	YES or NO YES or NO YES or NO	NO YES NO	Indicates if HC, CO, and NO_x emissions, respectively, are to be considered.
P-8 (Omit if QISMAP=NO	IREAD	51	I1	INTLOC	--	1-3	2	Specifies intersection location: 1=CBD 2=Suburban/commercial 3=Residential/other
P-9	IREAD	51-52	I2	KHR1	Hour of Day	1-24	7	Specifies first hour of calculation.
		61-62	I2	NHRSIM	Hours	1-24 if QISMAP=NO 1-8 if QISMAP=YES	6	Specifies number of hours for which emission factors are to be calculated.
P-10 8 values per card, up to 3 cards	IREAD	1-80	8F10.2	TEMPS(I) I=1,NHRSIM	Deg(F)	0.-110.	60.	Ambient temperature for each hour of interest.

Table 9 (concluded)

Input	Logical Units Name	Column	Format	Variable Name	Units	Value Limits	Typical Value	Description
P-11 6 cards (omit if USRMYM=NO)	IREAD	1-80	20F4.3	MYM(MY, MODE) MY=1,20 MODE=1,6	$(mi/yr)/10^5$	>0.		Model year mileage distributions: Each record has 20 values of annual rate of mileage accrual by model year, starting with most recent model year, one record per vehicle type.
P-12 6 cards (omit if USRMYR=NO)	IREAD	1-80	20F4.3	MYR(MY, MODE) MY=1,20 MODE=1,6	FRACTION	0.-1.	0.08	Model year registration distributions: Same organization as for MYM except that each value is fraction of total registration by model year.
P-13 (omit if USRMIX=NO)	IREAD	1-36	6F6.3	VMTMX1	FRACTION	0.-1.	0.72	Fraction of travel by vehicle type for facility type freeway.
P-14 (omit if USRMIX=NO)	IREAD	1-36	6F6.3	VMTMX2	FRACTION	0.-1.	0.70	Fraction of travel by vehicle type for facility type nonfreeway.
P-15 (omit if INSPEC=NO AND/OR QISMAP=YES	IREAD	51-54	I4	ICYIM	--	1970-1995	1982	Initial year of I/M program.
		56-57	I2	ISTRIN	Percent	10-50	20	Stringency level for I/M program.
		59	I1	IMTFLG	--	0 or 1	1	Specifies inclusion of mechanic training (1=YES, 0=NO).
		61-64	I4	MODYR1	--	1951-1995	1951	Specifies oldest model year to be inspected.
		66-69	I4	MODYR2	--	1951-1995 and > MODYR1	1995	Specifies newest model year to be inspected.

Table 10

INPUTS FOR MAIN PROGRAM AND EMISSION RATE MODULE

Input	Logical Unit Name	Column	Format	Variable Name	Units	Value Limits	Typical Value	Description
E-1	NCARD1	51-53	A3	QPIN	--	YES or NO	YES	Indicates if input parameters to be printed.
E-2	NCARD1	51-53	A3	QPGD1	--	YES or NO	NO	Indicates if grid of primary traffic emissions to be printed.
E-3	NCARD1	51-53	A3	QPGD2	--	YES or NO	NO	Indicates if grid of secondary traffic emissions to be printed.
E-4	NCARD1	51-53	A3	QPGDT	--	YES or NO	YES	Indicates if grid of total traffic emissions to be printed.
E-5	NCARD1	51-53	A3	QPFILE	--	YES or NO	NO	Indicates if traffic link file with link emissions to be printed.
E-6	NCARD1	51-53 61-63 71-73	A3 A3 A3	QPOL(1) QPOL(2) QPOL(3)	-- -- --	YES OR NO YES OR NO YES OR NO	NO YES NO	Indicates if HC, CO, and NO_x emissions respectively, to be considered. (Must be the same as input to the emissions preprocessor, Input P-7.)
E-7	NCARD1	51-53	A3	QAPRAC	--	YES or NO	YES	Indicates if diffusion model to be used.
E-8	NCARD1	51-53	A3	QSEC	--	YES or NO	YES	Indicates if secondary traffic to be automatically computed.
		56-58	A3	QBIG	--	YES or NO	YES	Indicates if primary traffic file is to be reduced for computational efficiency.
		61-70	F10.0	VMTMIN	vehicles	≥ 0.0	0.0	Link VMT below which link emissions will be assigned to secondary grid. Must be zero if NCUT >0. (Omit if QBIG=NO.)
		73-76	I4	NCUT	--	≤ 1500	1500	Number of links to which primary traffic file is to be reduced. Must be zero if VMTMIN>0. (Omit if QBIG=NO.)
E-9	NCARD1	51-53	A3	QCAPR	--	YES or NO	YES	Indicates if capacity restraint to be used to compute speed (can be YES only if QSPD = NO).
E-10	NCARD1	51-53	A3	QHRVOL	--	YES or NO	NO	Indicates input traffic link data has hour-average traffic volumes, as opposed to average daily totals.
E-11	NCARD1	51-53	A3	QFHWA	--	YES or NO	YES	Indicates if traffic link data is FHWA format.
E-12	NCARD1	51-53	A3	QSPD	--	YES or NO	NO	Indicates if speed is being specified in traffic link data (can be YES only if QFHWA = NO).

Table 10 (continued)

Input	Logical Unit Name	Column	Format	Variable Name	Units	Value Limits	Typical Value	Description
E-13	NCARD1	51-55	A5	AREAID	--	--	--	Name of the region.
E-14	NCARD1	51-52	A2	ALT	--	HI or LO	LO	Indicates which altitude was used when preprocessor computed emission factors.
E-15	NCARD1	51-53	A3	CALIF	--	YES or NO	NO	Indicates whether or not emission factors are for California.
E-16	NCARD1	51-53	I3	NGRIDE	--	1 to 25	15	Number of grid squares East of grid origin, Right Justify.
		61-63	I3	NGRIDN	--	1 to 25	15	Number of grid squares North of grid origin, Right Justify.
		71-80	F10.0	GSIZE	km	0.1 to 10	3.	Grid size (IF QAPRAC = YES, 3 km is med).
E-17	NCARD1	51-60 61-70	F10.0 F10.0	ORIGE ORIGN	Variable Variable	-- --	0.0 0.0	Coordinates of the grid origin in the same unit as used to define link locations in traffic link data.
		71-80	F10.0	GVERT	Variable	--	0.016093	Factor to convert link node units (0.01 mi) used in traffic link data to grid units (km)
E-18a	INPT	1-80	8F10.0	DTRAF (1,1,IHR) IHR=1,24	Fraction	0 to 1	0.0821	Three cards giving the fraction of the daily primary traffic within each of the 24 hours, for weekdays, on freeways in a CBD Locale in one direction.
E-18b	INPT	1-80	8F10.0	DTRAF (2,1,IHR) IHR=1,24	Fraction	0 to 1	0.1268	Same as above except for traffic in the opposite direction.

Table 10 (continued)

<table>
<tr><th>Input</th><th>Logical Unit Name</th><th>Column</th><th>Format</th><th>Variable Name</th><th>Units</th><th>Value Limits</th><th>Typical Value</th><th>Description</th></tr>
<tr><td>E-18a and E-18b (Repeat 9 times, 54 cards)</td><td>INPT</td><td>1-80</td><td>8F10.0</td><td>DTRAF (1,K,IHR)
DTRAF (2,K,IHR)
IHR=1,24
K=2,10</td><td>Fraction</td><td>0 to 1</td><td></td><td>Similar to preceding description for E-18a (1) and E-18b (1); 9 sets of 6 cards as follows:
<table>
<tr><th>Repetition</th><th>K</th><th>Locale</th><th>Facility</th></tr>
<tr><td>1</td><td>2</td><td>Suburban & Core City Commercial</td><td>Freeway</td></tr>
<tr><td>2</td><td>3</td><td>Residential</td><td>Freeway</td></tr>
<tr><td>3</td><td>4</td><td>Industrial</td><td>Freeway</td></tr>
<tr><td>4</td><td>5</td><td>Rural/other</td><td>Freeway</td></tr>
<tr><td>5</td><td>6</td><td>CBD</td><td>Nonfreeway</td></tr>
<tr><td>6</td><td>7</td><td>Suburban & Core City Commercial</td><td>Nonfreeway</td></tr>
<tr><td>7</td><td>8</td><td>Residential</td><td>Nonfreeway</td></tr>
<tr><td>8</td><td>9</td><td>Industrial</td><td>Nonfreeway</td></tr>
<tr><td>9</td><td>10</td><td>Rural/other</td><td>Nonfreeway</td></tr>
</table></td></tr>
<tr><td>E-19 and E-20</td><td>INPT</td><td>1-80</td><td>8F10.0</td><td>DTRAF (1,K,IHR)
DTRAF (2,K,IHR)
IHR=1,24
K=11,12</td><td>Fraction</td><td>>0.</td><td></td><td>Similar to E-18a and E-18b, 2 sets of 6 cards--the first 6 cards for Saturday (K=11) for two facilities all locales, the second 6 cards for Sunday (K=12) for two facilities and all locales, expressed as fraction of weekday traffic.</td></tr>
<tr><td>E-21</td><td>INPT</td><td>1-80</td><td>8F10.0</td><td>DTRAF2 (1,IHR)
IHR=1,24</td><td>Fraction</td><td>0. to 1.</td><td>0.1221</td><td>Three cards giving the fraction of the daily secondary traffic within each of the 24 hours for a weekday.</td></tr>
<tr><td>E-22</td><td>INPT</td><td>1-80</td><td>8F10.0</td><td>DTRAF2 (2,IHR)
IHR=1,24</td><td>Fraction</td><td>0. to 1.</td><td>0.0811</td><td>Saturday fractions of secondary traffic/hr, expressed as fraction of weekday traffic</td></tr>
<tr><td>E-23</td><td>INPT</td><td>1-80</td><td>8F10.0</td><td>DTRAF2 (3,IHR)
IHR=1,24</td><td>Fraction</td><td>0. to 1.</td><td>0.0622</td><td>Sunday fractions of secondary traffic/hr, expressed as fraction of weekday traffic.</td></tr>
<tr><td>E-24</td><td>INPT</td><td>1-40</td><td>4F10.0</td><td>SEASON(J)
J=1,4</td><td>--</td><td>>0.</td><td>1.02</td><td>Factor for seasonal adjustment of ADT,J=1, 2,3,4 for winter, spring, summer, fall, respectively.</td></tr>
<tr><td>E-25</td><td>INPT</td><td>1-10</td><td>F10.0</td><td>AVGSP2</td><td>mph</td><td>>0.</td><td>19.6</td><td>Average speed of secondary traffic.</td></tr>
</table>

Table 10 (continued)

Input	Logical Unit Name	Column	Format	Variable Name	Units	Value Limits	Typical Value	Description
E-26 (Omit if QSPD=YES)	INPT	1-80	10F8.0	SPD (IFAC, LOCL) IFAC=1,2 LOCL=1,5	mph	>0	55.0	Freeflow speed as a function of facility and locale where the first 5 entries are for freeways in CBD, Suburban/Core City Commercial, Residential, Industrial and Rural locales, respectively. Entries 6 through 10 are for nonfreeways in these same locales.
E-27 (Omit if QCAPR=NO or QSPD=YES)	INPT	1-16	2F8.0	DEFCAP (IFAC) IFAC=1,2	Vehicles/hr	>0	2500.	Default value of nondirectional capacity by facility type, first entry is for freeways, second entry for nonfreeways.
E-28 I=1,5 (Omit if QCAPR=YES or QSPD=YES)	INPT	1-80	16F5.2	ADJSPD (1,LOCL, IHR) LOCL=1,5 IHR=06,21	--	>0	0.75	Primary traffic speed adjustment factor for traffic in one direction in each of 16 day hours (06-21) Cards 1 through 5 contain this data for CBD, Suburban/Core City Commercial, Residential, Industrial, and Rural locales, respectively.
E-29 (Omit if QCAPR=YES or QSPD=YES	INPT	1-80	16F5.2	ADJSPD (2,LOCL, IHR) LOCL=1,5	mph	>0	1.00	Same as above, except in opposite direction.
E-30 (Omit if QSEC=NO)	INPT	1-50	5F8.0	LWFAC (LOCL) LOCL=1,5	--	>0	3.0	Factors reflecting the relative contribution of primary traffic in various locales to secondary traffic. Entries are for CBD, Suburban/Core City Commercial, Residential, Industrial, and Rural locales, respectively.
E-31 (Omit if QSEC=NO)	INPT	1-10	F10.0	TVMT	Vehicles	>0	1000000.	If QHRVOL=NO, enter total daily vehicle miles traveled in the area of interest. If QHVOL=YES, enter total for the hour under consideration.
E-32 (Omit if QSEC=YES)	INPT	1-8	F8.0	CLE	Percent	>0	25.	Daily secondary traffic as percent of primary traffic.

Table 10 (continued)

Input	Logical Unit Name	Column	Format	Variable Name	Units	Value Limits	Typical Value	Description
E-33 (Omit if QSEC=YES)	INPT	6-80	5X, 25F3.0	TRAF2(I,J) J=1,... NGRIDN I=1... NGRIDE	Percent	0-100	15.	The percentage of each grid square, J grid squares north and I grid squares east of the origin, occupied by secondary streets. Each card contains values for one row (E&W). Rows input, S to N.
E-34 I=1, number of traffic links (Omit if QFHWA=NO) On IBM machines, this file can be created by program COMSIS and no further input will be required	TFILEO=2	1-5	I5	LINKID(1)	--	number	1021	Anode of traffic link.
		6-10	I5	LINKID(2)	--	number	1039	Bnode of traffic link
		11-18	F8.0	X(1)	0.01 mi	number	44862.	Anode x-coordinate
		19-26	F8.0	Y(1)	0.01 mil	number	44865.	Anode y-coordinate
		27-34	F8.0	X(2)	0.01 mi	number	44983.	Bnode x-coordinate
		35-42	F8.0	Y(2)	0.01 mi	number	44998.	Bnode y-coordinate
		43-46	F4.2	LENGTH	miles	>0.	0.43	Link length
		47	I1	LANDUS	--	1 through 6	1	Land use designator: 1=Commercial 4=Rural 2=Residential 5=Open space 3=Industrial 6=Other
		48	I1	AREA	--	1 through 4	1	Area type designator: 1=CBD 3=Suburban 2=Core City 4=Other
		49	I1	IFAC	--	1 or 2	1	Facility type designator: 1=Freeway 2=Nonfreeway
		50-55	F6.0	VOL(1)	Vehicles	>0.	9600.	Daily traffic volume from A to B (hourly volume if QHRVOL=YES
		56-61	F6.0	VOL(2)	Vehicles	>0.	9780.	Same as above in opposite direction, B to A.
		62-66	F5.0	CAP	Vehicles /hr	>0.	2500.	Nondirectional hourly capacity.
		68-70	3I1	LU,AR,FC	--	>0.	--	Land use, area, and facility codes, respectively, on the historical record. For information, not used.

Table 10 (continued)

Input	Logical Unit Name	Column	Format	Variable Name	Units	Value Limits	Typical Value	Description
E-35 I=1, number of traffic links (Omit if QFHWA=YES)	INPT	1-8	F8.0	X(1)	0.01 mi	<9999999	68.	X and y-coordinate of one end of link.
		9-16	F8.0	Y(1)	0.01 mi	<9999999	115.	
		17-24	F8.0	X(2)	0.01 mi	<9999999	69.	X and y-coordinate of other end of link.
		25-32	F8.0	Y(2)	0.01 mi	<9999999	112.	
		33-40	F8.0	TVOL	vehicles	>0	9500.	Total daily traffic volume on the link. (Hourly volume if QHRVOL=YES).
		48	I1	IFAC	--	1 or 2	1	Facility type designator: 1=Freeway 2=Nonfreeway
		49-56	F8.0	LENGTH	miles	number (>0 if QBIG=NO)	0.38	Link length. If QBIG=YES, link may be flagged to assure inclusion in file by coding the length as a negative number.
		64	I1	LOCL	--	1,2,3,4,5	1	Locale type designator: 1=CBD 2=Suburban & Core City Commercial 3=Residential 4=Industrial 5=Rural
		65-72	F8.0	CAP	Vehicles/ hr	>0.	2200.	Nondirectional hourly capacity(omit if QSPD=YES).
		73-80	F8.0	SPEED	mph	>0.	0.25	Link speed (omit if QSPD=NO)
E-36 (Omit if QFHWA=YES)	INPT	1	F8.0		--	0-9	1	Indicates the end of traffic link data.
E-37 I=1, indefinite	INPT	1-4	I4	IYEAR	--	1970-1995	1980	Year for emission calculations. (Must be the same as input to the emissions preprocessor, Input P-6)
		5-8	I4	ISEA	--	1,2,3,4	3	Season of the year (right justify): 1=Winter 3=Summer 2=Spring 4=Fall
		9-12	I4	IDAY	--	1,...7	2	Day of the week (1=Sunday). Right justify--use 1 for holidays.

Table 10 (concluded)

Input	Logical Unit Name	Column	Format	Variable Name	Units	Value Limits	Typical Value	Description
		13-16	I4	IHOUR	--	1,...,24	8	Hour of the day (1=midnight to 1 a.m.), right justify. (Must be one of the hours for which the emissions preprocessor was run.)
		17-24	F8.0	TEMP	°F	number	65.	Temperature in the hour of interest, right justify. (Must be the same as input to the emissions preprocessor.)
		31-34	A4	NDIT	--	STOP or MORE	MORE	If NDIT=MORE, emissions calculations are continued and this card is repeated with new values for next case.

may specify either how many (up to 1500) links are to be retained or the minimum VMT for which links should be retained. If the number of links is specified, the minimum VMT must be set to zero; if the minimum VMT is specified, the number of links must be set to zero. If the VMT specified calls for more than 1500 links to be retained, the program will stop and print that this condition has occurred. The user is referred to Section II-D-4 for further discussion of this option.

Cards E-16 and E-17 define the grid system for the emissions. The number of grid squares is limited to 25 in north-south and east-west directions. If the diffusion module is to be used, the grid size will be 3 km; otherwise any reasonable nonzero value can be used--say 0.1 km to 10 km. The origin of the grid system is identified by the next input. The coordinates must be specified in the same system as is used for the traffic node coordinates and in units of 0.01 mile. These coordinates define the southwest corner of the grid. The conversion factor is 0.016093, the factor by which the link node units (0.01 mile) must be multiplied to convert to kilometers.

The next 72 cards define the diurnal traffic cycles appropriate to different kinds of roadway, areas of the city, and days of the week. The first 60 of these inputs are in groups of 6. The first 3 cards in each group of 6 provide 24 values of the fraction of the daily traffic in one direction for each hour of the day, beginning with the hour between 00 and 01, local time. The next 3 cards show the fractions for each hour for traffic in the opposite direction. Table 10 shows the combinations of roadway type and locale that are required and the order of their input.

Six cards follow in two groups of three, giving the diurnal traffic cycles (expressed as fractions of average weekday traffic) for the primary streets contained in the basic traffic file. The two groups of three cards are for Saturdays and Sundays (holidays). The final nine cards are for the diurnal traffic cycles on those streets not included in the primary traffic file--for weekdays, Saturdays, and Sundays (holidays). On weekend days, the diurnal variability is assumed the same in both directions for different locales and roadway types; similarly for all the secondary traffic.

The diurnal traffic cycles used as input should be obtained from local measurements. Table 11 gives some examples based on measurements made on freeways in the San Francisco Bay Area (Lee and Chang, 1973) and Seattle (the CBD values are based on data collected by the Washington State Highway Commission). Table 12 gives examples of diurnal traffic patterns on nonfreeways. Table 13 gives diurnal cycles for Saturdays

Table 11

EXAMPLES OF WEEKDAY DIURNAL TRAFFIC CYCLES ON FREEWAYS IN THE SAN FRANCISCO BAY AREA

Hour Ending (local time)	CBD*		Commercial		Residential		Industrial		Rural	
	NB†	SB	NB	SB	NB	SB	NB	SB	EB	WB
00	.017	.014	.013	.012	.007	.017	.009	.012	.022	.011
01	.010	.007	.004	.006	.003	.005	.006	.006	.011	.006
02	.006	.004	.004	.004	.002	.003	.004	.004	.007	.005
03	.004	.004	.002	.001	.001	.001	.003	.003	.005	.004
04	.004	.006	.003	.001	.000	.001	.005	.004	.005	.007
05	.007	.016	.005	.005	.009	.001	.011	.008	.007	.023
06	.022	.062	.033	.026	.077	.009	.055	.047	.019	.110
07	.057	.097	.127	.079	.175	.041	.094	.069	.053	.117
08	.055	.075	.130	.086	.131	.049	.072	.053	.045	.083
09	.044	.052	.066	.049	.056	.034	.059	.052	.045	.061
010	.044	.051	.048	.039	.045	.032	.032	.055	.045	.054
011	.050	.054	.043	.040	.041	.034	.058	.056	.047	.049
012	.057	.049	.047	.043	.039	.035	.054	.052	.043	.045
013	.053	.056	.042	.046	.042	.035	.058	.061	.050	.046
014	.059	.063	.045	.052	.041	.043	.059	.063	.053	.050
015	.078	.067	.051	.071	.057	.070	.070	.073	.070	.050
016	.110	.072	.070	.091	.059	.163	.083	.088	.099	.065
017	.099	.064	.073	.103	.059	.181	.068	.097	.101	.058
018	.060	.047	.055	.074	.045	.101	.051	.067	.095	.042
019	.045	.039	.042	.048	.048	.051	.039	.041	.045	.037
020	.033	.027	.031	.035	.032	.028	.033	.029	.036	.021
021	.035	.027	.026	.033	.021	.024	.034	.026	.039	.019
022	.028	.026	.020	.029	.023	.025	.023	.018	.033	.021
023	.024	.022	.017	.025	.013	.017	.018	.019	.025	.017
Total	100.1	100.1	99.8	99.8	100.1	100.0	99.8	100.3	100.0	100.1

*These data are from Seattle; others are San Francisco Bay Area Locales.

†Directions:

NB = Northbound
SB = Southbound
EB = Eastbound
WB = Westbound

Table 12

EXAMPLES OF WEEKDAY DIURNAL TRAFFIC CYCLES ON NONFREEWAY STREETS IN THE SAN FRANCISCO BAY AREA

Hour Ending (local time)	CBD*		Commercial		Residential		Industrial		Rural	
	NB†	SB	EB	WB	NB	SB	EB	WB	EB	WB
00	.013	.015	.008	.014	.006	.021	.015	.010	.007	.016
01	.006	.008	.004	.007	.003	.010	.007	.004	.002	.009
02	.003	.006	.003	.005	.002	.005	.005	.004	.002	.005
03	.004	.004	.002	.003	.002	.003	.004	.002	.001	.002
04	.002	.004	.002	.002	.003	.002	.002	.005	.012	.004
05	.003	.007	.007	.002	.015	.003	.004	.018	.012	.003
06	.017	.027	.036	.010	.078	.009	.024	.066	.056	.017
07	.035	.061	.101	.031	.149	.033	.086	.103	.161	.054
08	.036	.052	.081	.041	.077	.036	.057	.079	.091	.046
09	.039	.040	.051	.038	.059	.034	.049	.001	.058	.037
010	.048	.050	.052	.046	.052	.040	.051	.057	.058	.051
011	.067	.059	.057	.055	.051	.053	.053	.057	.055	.052
012	.104	.078	.064	.068	.052	.057	.057	.056	.045	.048
013	.068	.081	.066	.060	.049	.064	.064	.056	.052	.051
014	.070	.070	.061	.064	.058	.067	.067	.061	.062	.057
015	.071	.066	.065	.073	.071	.074	.074	.062	.066	.073
016	.095	.077	.068	.097	.056	.099	.099	.079	.064	.127
017	.081	.072	.052	.121	.052	.079	.079	.065	.059	.125
018	.057	.049	.052	.081	.055	.052	.052	.054	.054	.063
019	.048	.043	.052	.058	.043	.036	.036	.031	.032	.035
020	.046	.047	.045	.035	.021	.032	.032	.019	.017	.030
021	.039	.036	.028	.038	.017	.039	.039	.018	.012	.040
022	.028	.026	.025	.031	.017	.027	.027	.016	.019	.031
023	.020	.021	.018	.019	.011	.019	.019	.016	.015	.022
Total	1.000	0.999	1.000	0.999	0.999	1.002	1.002	0.999	1.001	0.998

*These data are from Seattle, others are San Franciosco Bay Area Locales.

†Directions:
NB = Northbound
SB = Southbound
EB = Eastbound
WB = Westbound

Table 13

EXAMPLES OF SATURDAY AND SUNDAY TRAFFIC CYCLES IN ST. LOUIS, MISSOURI

(Fraction of average weekday traffic.)

Hour	Saturday	Sunday
0-1	0.031	0.029
1-2	0.028	0.021
2-3	0.013	0.012
3-4	0.009	0.008
4-5	0.007	0.005
5-6	0.008	0.005
6-7	0.014	0.006
7-8	0.019	0.006
8-9	0.025	0.011
9-10	0.034	0.012
10-11	0.036	0.015
11-12	0.042	0.022
12-13	0.044	0.024
13-14	0.042	0.023
14-15	0.039	0.027
15-16	0.038	0.025
16-17	0.038	0.025
17-18	0.040	0.024
18-19	0.033	0.023
19-20	0.029	0.02
20-21	0.029	0.021
21-22	0.037	0.020
23-24	0.035	0.015
Total	0.671	0.401

and Sundays, as observed in St. Louis, Missouri (Ludwig and Dabberdt, 1972). We wish to emphasize that only examples are given here and local measurements should normally be used to take full advantage of the detail with which the model can treat these factors.

Seasonal adjustment factors define how traffic volumes change with season (winter includes December, January and February; spring includes March through May, etc.). If the seasonal volume is equal to the yearly average, then the entry is 1.0, if 5% higher, then 1.05 etc. The data must be obtained for the local area under consideration.

The input of average speed on secondary streets (card E-25) refers to route speed. That is, it includes time taken for decelerations, stops, accelerations, and other changes of speed.

From this point, the inputs vary according to the options that have been chosen. If speed information is not included for the links in the primary traffic file, then some prototype values must be input. One value is required for each combination of locale and roadway type (freeway/nonfreeway). If speeds are to be determined by capacity-restraint formulae, then values of freeway and nonfreeway capacities should be supplied at input E-27 (see Table 10).

If speeds are not determined by capacity-restraint or are not input with the traffic data, then speed adjustment factors must be supplied for hours 7 (0600 to 0700) through 21 (2000 to 2100) local time. During the night hours, speed is assumed to be that specified for the roadway type and locale (inputs E-26). The speed adjustment factors should correspond to inputs E-18a and E-18b. That is, the lower speed adjustment factors should correspond to the larger fractions of daily traffic for each of the two directions.

When the emissions from secondary traffic are to be assigned to the grid squares automatically (QSEC=YES, input E-8), then it is necessary to provide estimates of the relative importance of secondary traffic relative to primary traffic in each of the five different locales. For instance, in CBD and rural areas it is anticipated that nearly all the traffic will occur on streets in the primary traffic file. In commercial, industrial, and residential locales, the secondary traffic is likely to be of greater importance. Estimates must be made on the basis of the region being modeled and the available traffic file. A generalized set of values is not possible. The total average daily traffic in the region covered by the primary traffic file must also be input when this option is used. This total must be larger than the total vehicle miles traveled on all the links in the primary file.

The other option for alloting secondary traffic to the grid squares uses the same method as APRAC-1A (Mancuso and Ludwig, 1972). In this option the model requires an estimate of the total secondary traffic expressed as a percentage of the total vehicle miles on the primary traffic input file. It also requires an estimate of the percentage of each grid square that is occupied by secondary streets.

The next required inputs are the primary traffic data. If an FHWA tape has been used, it will have been read and a FORTRAN-addressable file created. This will have been done by the program COMSIS. If a non-IBM computer is used, the COMSIS created tape will be read from logical unit two. If an IBM computer is used, the program COMSIS can be included in the job string so that no other card or tape inputs will be required. If other traffic inputs are used, they must be put in the format given in Table 10, input E-35. Reading of these traffic data is terminated when a card with a number in column 1 is encountered. (The program checks to see if the first variable on the card is greater than 9999999. If it is not, another card E-35 is read; if it is, that card is taken as input E-36, the terminator card. When coding inputs E-35, care must be taken that either no number is entered in column 1 or that a decimal point is included.)

If the primary traffic file reduction option has been exercised (QBIG=YES), certain traffic links may be flagged to insure their inclusion in the reduced file, even if their VMT is below the minimum. This is done by coding the link length on card E-35 as a negative number. Because of format limitations, any flagged link must be less than 10 miles long. Several links may be flagged, but the user is advised to limit the number flagged to less than thirty, or the benefit of the link reduction may begin to be compromised. If QBIG=NO, all link lengths must be positive.

If gridded emissions are desired but no diffusion calculations are planned, then input E-37 is used to define the conditions for which the emissions are to be calculated. A series of calculations of gridded emissions may be made so long as the year is not changed. The traffic network must also remain the same through the series. This, in turn, means that the altitude type (high or low) and control device type (California or non-California) must also remain constant through the series.

Card E-37 is read once for each run. When only gridded emissions are desired, several runs (up to 24) can be made at a time by using repetitions of input E-37 with ENDIT="MORE" until the last case.

E. Diffusion Module

The inputs required to operate the diffusion module are enumerated in Table 14. The first several of these inputs are required to define the region and the types of calculations to be made. Card D-1 defines the city and card D-2 the number of receptors for which calculations are to be made. If more than ten receptors are included, the model will only calculate concentrations for a single hour. Concentrations for one day (24 hours) may be calculated for 1 to 10 locations, unless the intersection model is to be used, in which case concentrations may be computed for no more than 8 hours.

The next set of inputs defines the coordinates of the receptors in kilometers with the origin at the same place as the emissions grid.

If multiple wind inputs are to be used, their number is input on card D-4. A value of 1 causes the model to use the airport meteorological data from input D-13. The locations of wind stations are input on card D-5, again in kilometers with origin coincident with that of the emissions grid.

The next card, D-6, defines what local source model, if any, is to be used. If the street canyon model is to be used (QSTRT="YES"), card D-6a is required to define the dimensions and traffic conditions of the street canyon. The street canyon receptor must be receptor number 1, and receptor coordinates should be input accordingly on card D-3. If the intersection line-source model is to be used (QISMAP="YES"), card D-6b and D-6c are required to define the geometric characteristics of the intersection.

The coordinates of the end points of the intersection links are used to identify the corresponding streets in the traffic file, so it is important that they match those given in the traffic file inputs. Although default specifications are provided, it is desirable that the intersection links be included in the traffic file so that the pertinent information concerning facility and locale can be obtained.

Only one local model may be used at a time; that is, QISMAP and QSTRT may not both be "yes". However, it is not required that a local model be used, so they may both be "no".

The next card, D-7, tells the model whether or not the day being modeled is a holiday. This card must be included, but it should be blank if the modeled day is not a holiday.

The next card, D-8 is used to specify the duration of the run. The first and last hour for which calculations are desired is entered.

Table 14

INPUTS FOR DIFFUSION CALCULATIONS (QAPRAC=YES)

Input	Logical Unit Name	Column	Format	Variable Name	Units	Value Limits	Typical Value	Description
D1	NCARD1	41-45	F5.1	SLAT	Degrees latitude	-90. to 90	38.6	City latitude (positive=north).
		46-50	F5.1	POP	10^6 people	0.1-999.9	2.7	Population of the metropolitan area. Coordinates of city center.
		51-60	F10.3	XXT	km	>0.	22.6	
		61-70	F10.3	YYT	km	>0.	110.3	
D2	NCARD1	41-43	I3	NRECP	--	1-625	9	Number of receptors--no more than 625--Right justify. If more than 1-hour of calculations, must be ≤10;multiday=1.
D3	NCARD1	6-20	5X,5(I3, 2F6.2)	IDOFRC	--	1-999	23	Identification number and coordinates of receptors--5 to a card. Total number of receptors = NRECP; number of cards = 1 + Integer(NRECP/5).
		21-35 36-50 51-65 66-80		XR, YR	km	0.-999.99	11.4,21.2	
D4	NCARD1	41-43	I3	NWND	--	1-100	10	Number of wind measurement stations--no more than 100. For NWND = 1, model uses wind data input at D13. Right justify.
D5	NCARD1	6-20	5X,5(I3, 2F6.2)	IDOFW	--	1-999	17	Identification number and wind station coordinates--5 to a card. Total number of stations = NWND; Total number of cards = 1 + Integer(NWND/5).
		21-35 36-50 51-65 66-80		XW, YW	km	0.-999.99	13.2,84.6	
D6	NCARD1	41-43	A3	QSTRT		YES/NO	YES	QSTRT = YES; street canyon model used. QISMAP = YES; special line source model used. QSTRT and QISMAP may not both be yes.
		51-53	A3	QISMAP		NO/YES	NO	

Table 14 (continued)

Input	Logical Unit Name	Column	Format	Variable Name	Units	Value Limits	Typical Value	Description
D6a (omit if QSTRT=NO)	NCARD1	41-44	F4.1	STHT	m	1-999.	20.0	Street canyon height and width (m); distance (horizontal and vertical,m) to nearest traffic lane; street locale type--see values for k in Table 11, inputs E-18a and E-18b; daily traffic volume, average off-peak speed. Street orientation, receptor to right when facing STDIR. Two-way street capacities.
		45-48	F4.1	STWDTH	m	1-999.	15.	
		49-52	F4.1	STRTXX	m	1-999.	5.	
		53-56	F4.1	STRTZZ	m	1-999.	3.	
		57-58	I2	LOCST	--	1-12	7	
		59-64	F6.0	STVOL	veh-day^{-1}	0-999999	10000	
		65-68	F4.0	SPEEDS	mph	0-60.	20.	
		69-72	F4.0	STDIR	Deg CW from N	0-360.	180.	
		73-78	F6.0	CAPCAN	veh-hr^{-1}	1-999999	20000.	
D6b (omit if QISMAP=NO)	NCARD1	26-29	F4.1	ZCONST	m	0-999.	2.	Initial dispersion from exhausts. Heights of lanes above receptor 4 inbound and 4 outbound. No. of lanes at intersection; 4 directions inbound and 4 outbound.
		30-61	8F4.0	HEIGHT(I) I=1,8	m	0-9999	0.	
		62-77	8I2	NLANE(I) I=1,8	--	0-99	3	
D6c (omit if QISMAP=NO)	NCARD1	0-80	4(4F5.0)	[XII1(I), YII1(I), XII2(I), YII2(I)] I=1,4	0.01 mi	0-999999	1007.	End point coordinates for intersection. The four links of the intersection.
D7	NCARD1	31-35	30X I5	NHØL	--	0101-1231	1225 (Christmas)	This card specifies whether day being modeled is a holiday. If it is not, include a blank card. Right justify.
D8	NCARD1	41-45 46-50	40X, 2I5	KHR1 LASTHR	hours of day	1-24	7	This card specifies first and last hours of calculations (local standard time). No more than 24 hours may be specified. If QISMAP=YES, no more than 8 hours may be specified. If more than 10 receptors, enter hour of calculation (one only) in both fields. Right justify.
D9	NCARD1	41-43	40X, A3	CRUD	--	CO, HC, or NOX	CO	Pollutant for which concentrations are to be calculated; left justify. (This input must be the same as the selection made in the main program, Input E-6, and in the emission factor preprocessor, Input P-7.)
D10	NCARD1	41-45 46-50 etc.	40X 8F5.2	UPWNDC	μg m^{-3}	0.-999.99	300.	Average background concentrations of the pollutant CRUD entering area from each of 16 upwind directions, 8/card 1 = NNE, 2 = NE,....., 16 = N.

Table 14 (continued)

Input	Logical Unit Name	Column	Format	Variable Name	Units	Value Limits	Typical Value	Description
D11	NCARD1	41-43	40X, A3	QMIX	--	YES/NO	YES	Is mixing height input directly? YES or NO. "NO" means radiosonde data must be supplied for calculating mixing heights--see inputs 12a and 12b (YES) or 12b and 12c (NO).
D12a (omit if QMIX=NO)	NCARDR	1-3,4-6 7-9 11-13 14-16, 17-19 etc.	5X,24F3.0	HMIX	10m	1-999	100.	One card containing mixing heights for each hour of day (1-24) to nearest 10m. If NRECP>10, include only one value with the mixing height for the hour of calculation in columns 1-3.
D12b	NCARDR	1-12	3A4	MSTA	--	--	STLOUIS	City name
		13-20	I8	IDAT	Date	--	760606	date (June 6, 1976)--right justify
		21-25	I5	MAXT	°F		83	maximum temp. for the day--right justify
		26-30	I5	MINT	°F		59	minimum temp. for the day--right justify
		31-35	I5	IDSC		0,+1	1	time indicator--right justify 0 = standard time +1 = daylight time.
D12c (omit if QMIX=YES)	NCARDR	23-26	F4.1	T	°C	--	-9.5	Radiosonde data, temperature and air pressure. An indefinite number of cards (less than 26). Terminates when 500 mb data card has been read. Data should include both standard and significant levels in order of decreasing pressure.
		40-44	F5.1	P	mb	≥500.	500.	
D13	NCARDX	9-10	I2	IHR	hour	0-23	23	24 cards give surface meteorological data: hour of day (stand. time), opaque cloud cover, temperature, wind direction (tens of degrees from north), wind speed. Must be input in ordered groups of 24, beginning with IHR = 0, ending with IHR = 23.
		11-15	I5	ICLD	tenths	0-10	0	
		16-20	I5	ITEMP	°F	--	60	
		26-30	I5	IWD	10°	0-36	36	
		31-35	F5.0	WS	knots	≥0.	7.	

Table 14 (concluded)

Input	Logical Unit Name	Column	Format	Variable Name	Units	Value Limits	Typical Value	Description
D14 (omit if NWND=1)	NCARDW	1-4, 5-10 11-14, 15-20, etc.	8(F4.0, F6.0)	WINDSP WINDIR	ms^{-1} degrees CW from north	0.-99. 0.-360.	3. 270. (west)	Each card may contain up to 8 pairs of wind speed and direction. First pair for first hour of the calculation (KHR1), last pair for last hour (LASTHR) of calculation. Data for each site begin on a new card. Wind data must be in same order as site coordinates are listed (cards D5). Missing data should be marked by negative values of speed.
D15a (omit if QISMAP=NO)	NCARDI	1-5 6-65 66-77	I5 12F5.0 4F3.3	IFLAG VOL(J,K) K=1,3 J=1,4	veh/hr or fraction	1-2 .01-99999	1 See Appendix C	Traffic parameters for intersection model. See Appendix C. IFLAG indicates whether volume or fraction traffic inputs are used.
				PFRAC(J) J=1,4	fraction	0.-1.	0.2	VOL(J,K) 4 groups of 3 values. Groups represent inbound traffic from N, E, S, W. Three values in group are through, right, and left turns. (IFLAG 2). PFRAC fraction of total inbound vehicles for each direction (N,E,S,W.) arriving in a platoon
D15b (omit if QISMAP=NO)	NCARDI	1-2 3-6 7-22 23-26 27-42 43-58 59-74	I2 I4 4F4.0 F4.0 4F4.0 4F4.0 4I4	ITYPC ICYCL PH(I) CI GCAP(I) RELART(I) NAL(I)	-- sec sec sec veh/hr sec --	1-5 $\geq \Sigma PH$ $\geq 0.$ $\geq 0.$ $\geq 0.$ -200.-200. 0-9999	1 60 30. 3. 3600 -10. 2	ITYPC designates type of intersection control (see Appendix C). ICYCL, cycle length of signal. PH are phase lengths (their sum $\leq$ ICYCL)(see Appendix C). CI is yellow time interval GCAP is the capacity of the intersection approaches. RELART is the arrival of platoons relative to the start of the green phase (see Appendix C). NAL is the number of lanes at intersection available for turns or through traffic. Cards D-15a and D-15b are input in pairs, one pair for each hour to be treated (maximum of 8 hours).

For runs with more than 10 receptors, the first and last hours are both set equal to the hour for which calculations are desired. (See Section III-E regarding run duration.)

The next input, D-9, specifies the pollutant for which the concentrations are to be calculated. The input used here must be one of the selections made in the emissions module at input E-6 and the emission factor preprocessor, input P-7. For diffusion model runs, only one pollutant may be specified. If the intersection model is to be used, that pollutant may not be NO_x.

If typical upwind concentrations of the selected pollutant are known for different directions, these concentrations may be entered (D-10). Two cards are required. If the upwind concentration as a function of wind direction is unknown, then either zeroes or typical background values should be entered here for each of the 16 directions.

If the mixing heights are to be input directly, QMIX is assigned the value "yes" on card type D-11 and the mixing heights for each hour of the day are entered on the D-12a input. If only one hour is being considered, just the mixing depth for that hour should be entered in the first field of D-12a. The program reads input D-12b, giving the information shown in Table 14. If the local time system on the day being modeled is not standard, an appropriate entry must be made. If the day is daylight time, IDSC is set to 1.

If mixing depths are to be calculated from radiosonde data, inputs D-12a are omitted and the radiosonde data are read after D-12b. The next inputs are the hourly weather data for all 24 hours of the day. If any hour being modeled is either sunset or later in the day than sunset, the radiosonde data for the next day (D-12c), as well as the surface observations for the first hour of the next day (D-13), must be included at the end of the data deck, following input D-15b.

A note should be made here regarding the labeling of time. Traditionally, the labels on hourly meteorological data would be 0000 to 2300 for 24 hours of data. Hourly traffic data is labeled from 1 to 24. These two ways of labeling are not inconsistent for the following reason. Hourly traffic data values are assumed to be averages over the hour preceding the hour indicated by the label, e.g., data for the hour labeled 1 pertain to an average over the 0000 to 0100 time period. Meteorological data, on the other hand, are instantaneous observations rather than hourly averages. An observation labeled 1 (for 0100) was taken very close to 0100 hours. Thus, when the model pairs meteorological data labeled 1 with traffic data labeled 1, there is not an inconsistency, even though the meteorological labels for one day vary from 0 to 23, while the traffic labels vary from 1 to 24. In choosing hours for which emissions and/or concentrations are to be calculated, the user should follow the 1 to 24 labeling convention, e.g., hour 1 is the average from 0000 to 0100.

If multiple winds are to be input, they follow the hourly weather data. All the hourly wind data for one station are entered before the next station's data are read. The inputs must be in the order that corresponds to the order used to enter the location coordinates at input D-5.

If the intersection/line source model is used (QISMAP="YES"), the hourly traffic and signalization information are read for each hour to be treated (up to 8 hours). With long runs, all 8 pairs of cards are input at one time.

Table 14 gives a brief description of the traffic parameters required for operation of the intersection model in connection with inputs D-6b and D-15b. A much more detailed description of these inputs is given in Appendix C. That appendix should be consulted before attempting to use the intersection model.

Table 15 provides a brief summary of all the input requirements for the model. This check list can be used to verify that all the required inputs are being used in the proper order.

Table 15

CHECKLIST OF INPUT REQUIREMENTS

Input No. (See Tables 9, 10, and 14)	No. of Cards	Values/Card	When Omitted?	Remarks
P-1 through P-4	1 each	1 to 2	Always included	Inputs to define run
P-5	1	1	Always included	Region location
P-6	1	1	Always included	Calendar year
P-7	1	3	Always included	Pollutants to be treated
P-8	1	1	P-1, QISMAP=NO	Intersection location
P-9	1	2	Always included	First hour and no. of hours of run
P-10	1-3	≤8	Always included	Temperatures of each hour of run
P-11	6	20	P-3, USRMYM=NO	Model year mileage distributions
P-12	6	20	P-3, USRMYR=NO	Model year registration distributions
P-13	1	6	P-4, USRMIX=NO	Vehicle type distribution for freeways
P-14	1	6	P-4, USRMIX=NO	Vehicle type distribution for nonfreeways
P-15	1	5	P-2, INSPEC=NO and/or P-1, QISMAP=YES	Inspection/maintenance information

Table 15 (continued)

CHECKLIST OF INPUT REQUIREMENTS

Input No. (See Tables 9, 10, and 14)	No. of Cards	Values/Card	When Omitted?	Remarks
START OF EMISSION RATE MODEL INPUTS				
E-1 through E-17	1 each	1 to 4	Always included	Inputs to define run
E-18(a/b)	60	8	Always included	Weekday diurnal cycles of primary traffic -2 directions x 5 locales x 2 facility types
E-19	6	8	Always included	Saturday diurnal cycles of primary traffic, 2 facilities
E-20	6	8	Always included	Sunday diurnal cycles of primary traffic, 2 facilities
E-21	3	8	Always included	Weekday diurnal cycles of secondary traffic
E-22	3	8	Always included	Saturday diurnal cycles of secondary traffic
E-23	3	8	Always included	Sunday diurnal cycles of secondary traffic
E-24	1	4	Always included	Seasonal traffic adjustments
E-25	1	1	Always included	Average speed of secondary traffic
E-26	1	10	E-12, QSPD=YES	Freeflow speeds by facility and locale

Table 15 (continued)

CHECKLIST OF INPUT REQUIREMENTS

Input No. (See Tables 9, 10 and 14)	No. of Cards	Values/Card	When Omitted ?	Remarks
E-27	1	2	E-9, QCAPR=NO	Default capacities by facility.
E-28 and E-29	10 (5 each)	16	E-9, QCAPR=YES or E-12, QSPD=YES	Diurnal speed adjustments by locale for two directions.
E-30	1	5	E-8, QSEC=NO	Locale weighting factors for secondary traffic.
E-31	1	1	E-8, QSEC=NO	Total vehicle miles in region.
E-32	1	1	E-8, QSEC=YES	Secondary traffic as percent of primary traffic.
E-33	NGRIDN (E-16)	NGRIDE (E-16)	E-8, QSEC=YES	Relative distributions of secondary traffic by grid square
E-34	Arbitrary	16	E-11, QFHWA=NO	FHWA traffic data (from file generated by program COMSIS)
E-35	Arbitrary	9	E-11, QFHWA=YES	Traffic data - non-FHWA source
E-36	1	1	E-11, QFHWA=YES	Terminator for non-FHWA traffic input
E-37	1	6	Always included	Header to define day season, temperature, etc.
(E-37, repeated)	1	6	E-7, QAPRAC=YES, or NDIT=STØP on preceding E-37 input	Repeats of Input E-37 are used to obtain several sets of gridded emissions when QAPRAC=NO

Table 15 (continued)

CHECKLIST OF INPUT REQUIREMENTS

Input No. (See Tables 9, 10 and 14)	No. of Cards	Values/Card	When Omitted?	Remarks
START OF DIFFUSION MODEL INPUTS			All the following are omitted if E-7, QAPRAC=NO	
D-1	1	4	Always included	Header card giving latitude, population, etc.
D-2	1	1	Always included	Number of receptors (NRECP)
D-3	Integer[NRECP/5]+1	≤ 15	Always included	ID's, and coordinates of receptors
D-4	1	1	Always included	Number of wind inputs (NWND)
D-5	Integer[NWND/5]+1	≤ 15	Always included	ID's, and coordinates of wind sites
D-6	1	2	Always included	Local diffusion model to be used
D-6a	1	8	D-6, QSTRT=NO	Defines street canyon features
D-6b	1	17	D-6, QISMAP=NO	Defines intersection link features
D-6c	1	16	D-6, QISMAP=NO	Defines intersection link coordinates
D-7	1	1	Always included	Defines holiday
D-8	1	2	Always included	First/last hours of run

Table 15 (concluded)

CHECKLIST OF INPUT REQUIREMENTS

Input No. (See Tables 9, 10 and 14)	No. of Cards	Values/Card	When Omitted?	Remarks
D-9	1	1	Always included	Pollutant to be treated, must be the same as P-7 and E-6
D-10	2	8	Always included	Upwind background concentrations
D-11	1	1	Always included	Defines mixing depth input type
D-12a	1	24	D-11, QMIX=NO	Direct input of hourly mixing heights
D-12b	1	5	Always included	Defines station, date, max./min. temps., daylight savings time
D-12c	≤25	2	D-11, QMIX=YES	Radiosonde data
D-13	24	5	Always included	Weather data
D-14	At least one card/wind site; 8-hours data/card; there must be data for each hour of run.	16	D-4, NWND=1	Wind data for up to 100 sites. May be either observations, or derived from streamline analyses
D-15a	1	17	D-6, QISMAP=NO	Intersection traffic parameters
D-15b	1	19	D-6, QISMAP=NO	Intersection signalization parameters
(D-15a, repeated)	1	17	D-6, QISMAP=NO	Repeats of Inputs D-15a,b, in pairs, for up to 8 hours.
(D-15b, repeated)	1	19	D-6, QISMAP=NO	

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Appendix A

THE COMPUTER PROGRAM

1. Introduction

This appendix contains a brief description of the function of each section of the APRAC-3/MOBILE1 package of computer programs. Flowcharts are included for some of the more complex subroutines. The second half of this appendix has the complete program listing. In general, the subroutines themselves include copious comments to assist the user. We have tried to avoid machine-specific FORTRAN statements. In some cases this has not been possible, so IBM/UNIVAC and CDC alternatives are included with the IMB/UNIVAC version set off as comment statements.

2. Preprocessing Programs

a. Program COMSIS

Program COMSIS is used to unpack the traffic information contained in FHWA System 360 traffic data tapes and to create a traffic data file suitable for use with the APRAC-3 program. The reader should consult the publications of the U.S. Department of Transportation (1972) for descriptions of the FHWA data tapes. This program can only be used on IBM (or completely compatible) equipment. On an IBM machine, the program COMSIS will be placed in the job string to create a file to be read subsequently by APRAC-3. The program COMSIS can also be used once with an IBM machine to create a tape traffic file that can be used with APRAC-3 on other machines. The first file of the program tape contains the FORTRAN source deck for program COMSIS.

b. Program PREMOD

The emission factor preprocessing program, PREMOD, is used to compute tables of emission factor according to the latest EPA mobile source emission factor methodology (currently MOBILE1) for use by the APRAC-3 emission rate and diffusion modules.

A simplified flowchart of the main program of the preprocessor was given in Figure 1 of the report. The main program, named PREMOD, calls several subroutines, many of which call other subroutines. The subroutine calling sequence of the preprocessor is listed in Table A-1;

lower-order subroutines are shown by successive indentations. The following discussions will assume the reader has some familiarity with the MOBILE1 mobile source emission factor methodology.

i. Subroutine SRIIN

This subroutine reads all of the data that specify the conditions for which emission factors are to be computed. The routine does some editing for obvious mistakes and stops computations when erroneous data are encountered. No subroutines are called by SRIIN, but the following labeled common blocks are used:

- COMMON/APRIN/
- COMMON/FLGCOM/
- COMMON/REGCOM/
- COMMON/MYMCOM/
- COMMON/IMCOM/

ii. Subroutine SRIFAC

This subroutine directly or indirectly calls several MOBILE1 subroutines to compute emission factors for various speeds, locales, facility types, and pollutants. SRIFAC also calls the subroutine SRICOR to compute modal correction factors if the intersection module of APRAC-3 is to be used. The subroutines called by SRIFAC are EFCALX and SRICOR. The following labeled common blocks are used:

- COMMON/APRIN/
- COMMON/CFACT/
- COMMON/EMFAC/
- COMMON/FLGCOM/
- COMMON/REGCOM/
- COMMON/LNKCOM/
- COMMON/MYMCOM/
- COMMON/IMCOM/
- COMMON/JUNK1/
- COMMON/RET1/

Table A-1

SUBROUTINES CALLED BY THE MAIN PROGRAM OF THE EMISSION FACTOR PREPROCESSOR (PREMOD)

- SRIIN
- TFCALX
- INITEX
  - -EFALTX
  - -BEFGEN
    - --GETCUM
  - -CCEVAX
- LDVIMX
- SRIFAC
  - -EFCALX
    - --BIGCFX
      - *SPFCLX
      - *GETCUM
      - *ALUH
      - *TRKOPC
  - -SRICOR
    - --BIGCFX
      - *SPFCLX
      - *GETCUM
      - *ALUH
    - --ALUH
- SRIOUT

iii. Subroutine SRICOR

This subroutine directly or indirectly calls several MOBILE1 subroutines to compute correction factors for the modal emissions used in APRAC-3's intersection model. A combined factor that corrects for temperature/cold starts, vehicle type mix, and air conditioning is created for various pollutants, model years, and speeds. Subroutine SRICOR calls subroutines BIGCFX and ALUH. The labeled common blocks used are:

- COMMON/CFACT/
- COMMON/FLGCOM/
- COMMON/LNKCOM/
- COMMON/JUNK1/
- COMMON/RET1/

iv. Subroutine SRIOUT

This subroutine prints all of the tables created by SRIFAC and SRICOR and writes them on permanent files ready to be read by APRAC-3. No other subroutines are called and the labeled common used are APRIN, EMFAC, and CFACT.

v. Subroutines TFCALX, INITEX, EFALTX, BEFGEN, GETCUM, CCEVAX, LDVIMX, BIGCFX, SPFCLX, ALUH, and TRKOPC

The following subroutines were taken without change from MOBILE1: TFCALX, INITEX, EFALTX, BEFGEN, GETCUM, CCEVAX, LDVIMX, BIGCFX, SPFCLX, ALUH, and TRKOPC. The function of each of these subroutines is described in the MOBILE1 User's Guide (Guthman, 1978) and the reader is referred to that document for further information regarding MOBILE1.

3. Descriptions of the Main Program and Subroutines (Emission Rate and Diffusion Modules)

a. APRAC-3, Main

A simplified flowchart for the main program was given in Figure 1 of the report. The function of the main program is to read the input data necessary to define the run type and most of the information necessary for the emissions calculations.

Table A-2

SUBROUTINES CALLED BY THE MAIN PROGRAM OF THE EMISSION RATE AND DIFFUSION MODEL (APRAC-3)

- ARELND
- BLOCK DATA
- CALALT
- EMOD
    - -GRID (also called by SEXTOR)
    - -PICKIT
    - -PRINCE
    - -ZAVE (also called by BIGLNK)
    - -GETZ (also called by BIGLNK)
- REFILE
- SECOND
- BIGLNK
    - -ZAVE
    - -GETZ
    - -SEXTOR
        - --GRID
- DIFMOD
    - -DIFF
        - --BASIC
        - --CALCON
        - --CALQUE
            - *CALLOC
        - --CALXOQ
        - --DEPTH
            - *RAOBHM
            - *SFCOB1

Table A-2(continued)

```
   --EMOD (also called by APRAC-3)
          (see above)

   --LOCLNK

   --MARIAH

   --NDAYWK

   --NSEAS

   --RAOBHM (also called by DEPTH)

   --RETRAF

   --SFCOB1 (also called by DEPTH)

   --SFCOB2

   --STABLE

   --STREET

   --WDBAR

-INT

   --INPTMI

   --MODMOD

      *COEFFS

      *DETERF

   --EMITX

   --INSEC

      *PLATON

   --LINE

      *CONCAL

         -SPACNG

         -XSIGN

      *CURTR
```

The main program, named APRAC-3, calls several subroutines and some of these subroutines call others. The Table A-2 shows the subroutines called by the main program. The lower-order subroutines are shown by successive indentations.

None of those subroutines listed below DIFMOD (except EMOD and its associated subroutines) are required when only gridded emissions are to be calculated. The tape listing of the program has the routines required for calculating gridded emissions listed in the second file; the third file contains the remainder of the program.

It should also be noted that the program does not require certain subroutines when the intersection/line source model is not used. The subroutines used only for intersection/line source modeling are, PICKIT, INPTMI, INT, and all the subroutines called from INT.

b. The Emissions Module

i. Subroutine EMOD

Figure A-1 gives a simplified flowchart for this subroutine. The purpose of this routine is to determine the emission rate for each link and to allot those emissions to the appropriate grid squares. It also allots secondary emissions and creates a special emissions file for use with the diffusion model, if required. The printing of the gridded emissions and traffic link information is also performed by this module, if called for.

EMOD calls the following subroutines directly:

- SUBROUTINE GRID
- SUBROUTINE PICKIT
- SUBROUTINE PRINCE

And uses the following labeled common blocks:

- COMMON/CLINE/
- COMMON/COMING/
- COMMONG/GRDEMS/
- COMMON/INOUTS/
- COMMON/LINDEX/
- COMMON/DAYLYT/

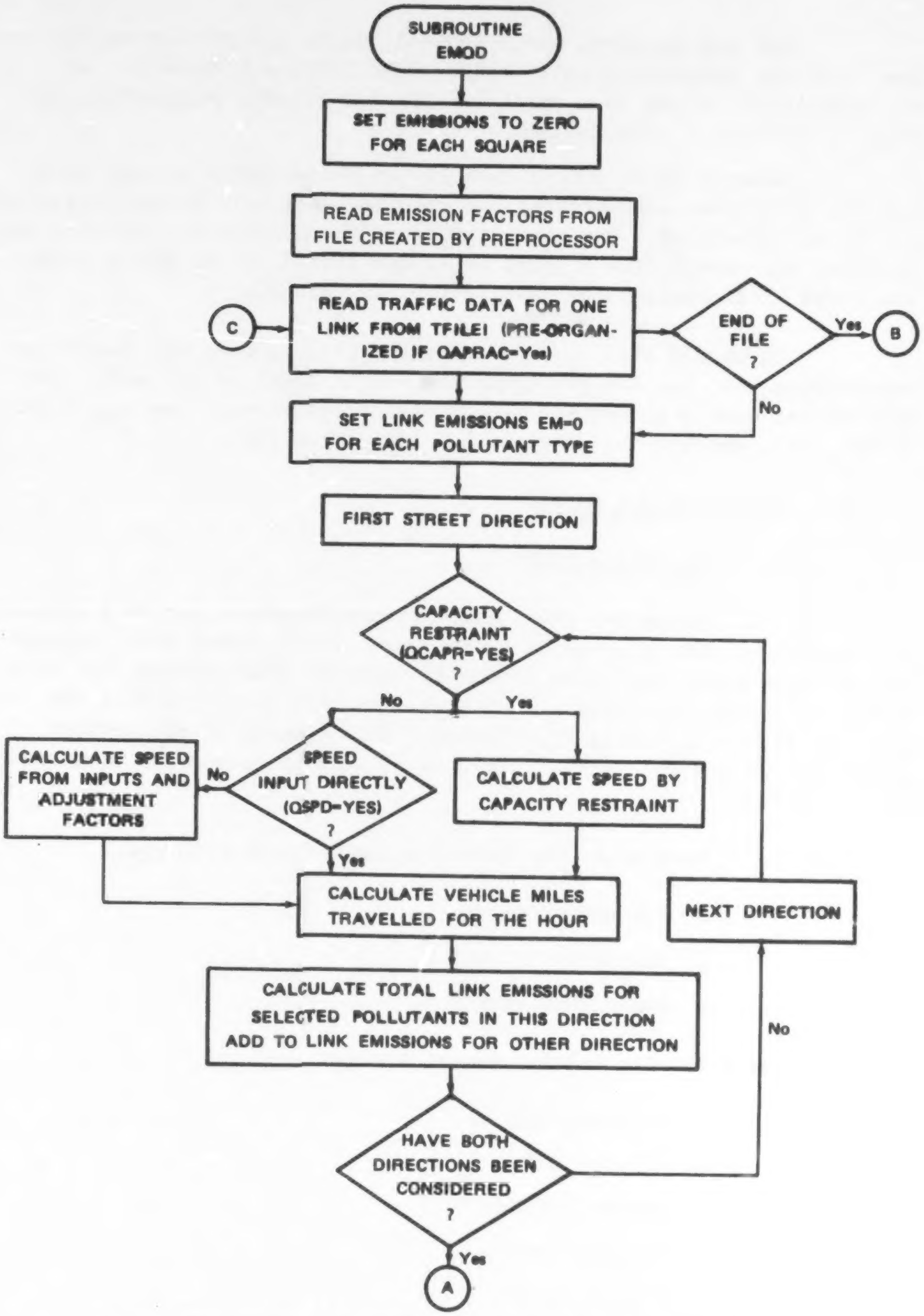
SUBROUTINE EMOD
SET EMISSIONS TO ZERO FOR EACH SQUARE
READ EMISSION FACTORS FROM FILE CREATED BY PREPROCESSOR
C
READ TRAFFIC DATA FOR ONE LINK FROM TFILE1 (PRE-ORGANIZED IF QAPRAC=Yes)
END OF FILE ?
Yes
B
No
SET LINK EMISSIONS EM=0 FOR EACH POLLUTANT TYPE
FIRST STREET DIRECTION
CAPACITY RESTRAINT (QCAPR=YES) ?
No
Yes
CALCULATE SPEED FROM INPUTS AND ADJUSTMENT FACTORS
No
SPEED INPUT DIRECTLY (QSPD=YES) ?
CALCULATE SPEED BY CAPACITY RESTRAINT
Yes
CALCULATE VEHICLE MILES TRAVELLED FOR THE HOUR
NEXT DIRECTION
CALCULATE TOTAL LINK EMISSIONS FOR SELECTED POLLUTANTS IN THIS DIRECTION ADD TO LINK EMISSIONS FOR OTHER DIRECTION
No
HAVE BOTH DIRECTIONS BEEN CONSIDERED ?
Yes
A

FIGURE A-1. SIMPLIFIED FLOW CHART FOR SUBROUTINE EMOD

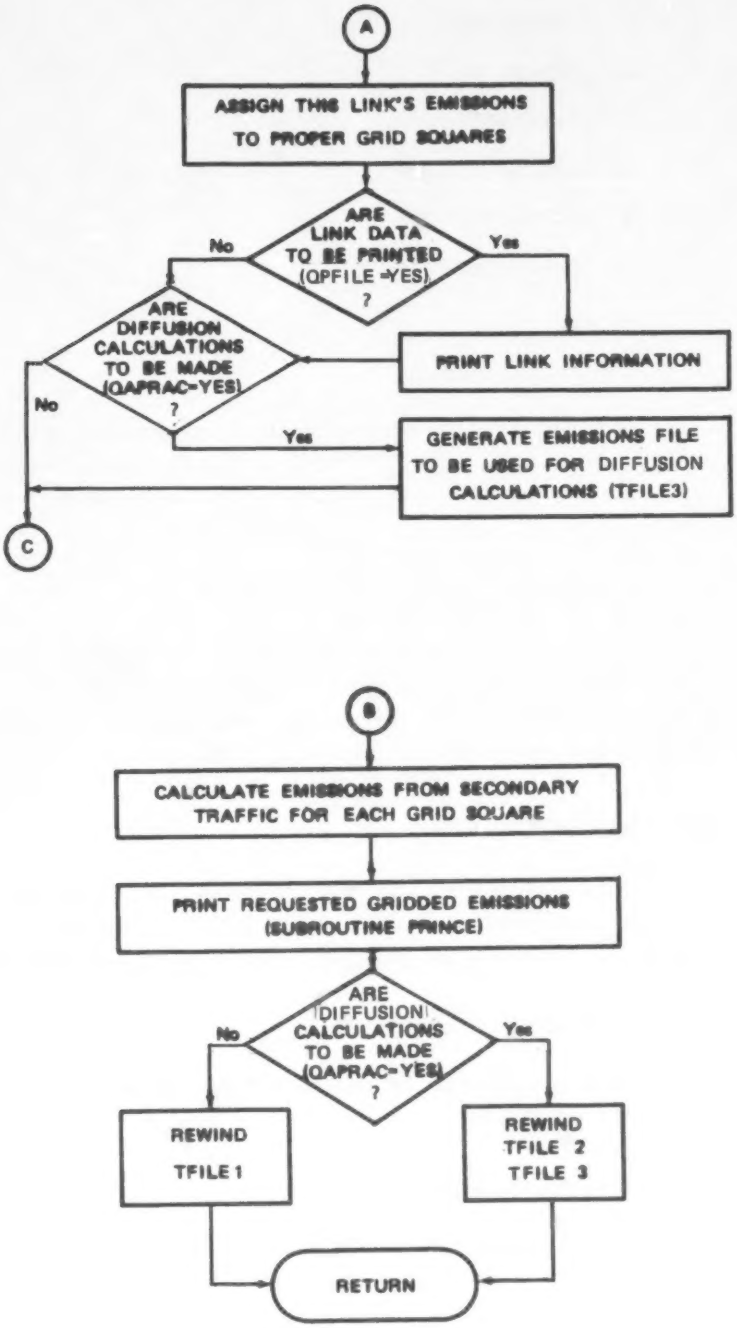
A
ASSIGN THIS LINK'S EMISSIONS TO PROPER GRID SQUARES
ARE LINK DATA TO BE PRINTED (QPFILE =YES) ?
No
Yes
PRINT LINK INFORMATION
ARE DIFFUSION CALCULATIONS TO BE MADE (QAPRAC=YES) ?
No
Yes
GENERATE EMISSIONS FILE TO BE USED FOR DIFFUSION CALCULATIONS (TFILE3)
C
B
CALCULATE EMISSIONS FROM SECONDARY TRAFFIC FOR EACH GRID SQUARE
PRINT REQUESTED GRIDDED EMISSIONS (SUBROUTINE PRINCE)
ARE DIFFUSION CALCULATIONS TO BE MADE (QAPRAC=YES) ?
No
Yes
REWIND TFILE 1
REWIND TFILE 2 TFILE 3
RETURN

FIGURE A-1 SIMPLIFIED FLOW CHART FOR SUBROUTINE EMOD (Concluded)

- COMMON/QUSTN1/
- COMMON/GG/
- COMMON/SFC/
- COMMON/ODDEND/
- COMMON/TFCSTF/
- COMMON/QUSTN2/

ii. Subroutine ARELND

This short subroutine is used to provide a land-use category derived from area type and traffic volume when land-use data are not available. No subroutines are called. The labeled common, QUSTN1, is used.

iii. Subroutine CALALT

This routine returns an indicator, LCODE, with values from from 1 to 4, to indicate the appropriate combination of low-altitude versus high-altitude and California versus non-California emission factors. No subroutines or common blocks are used.

iv. Subroutine GRID

This subroutine determines those grid squares through which a specified link passes and the fraction of that link which falls within each square. It uses no labeled common or other subroutines.

v. Subroutine PICKIT

This subroutine is discussed in connection with the intersection/line-source model.

vi. Subroutine PRINCE

This subroutine prints the gridded emissions. No other subroutines are called. The following labeled commons are used:

- COMMON/QUSTN1/
- COMMON/INOUTS/
- COMMON/GRDEMS/

vii. Subroutine ZAVE

This subroutine is used when the link file reduction option is exercised (QBIG=YES). It stores information on the largest traffic links (those retained in the primary traffic file after the file reduction is completed). It does not call any other subroutines, but uses common blocks CLDAT and CDAT2.

viii. Subroutine GETZ

This subroutine also is used when the link file reduction option is exercised. It retrieves data describing the links left in the primary traffic file from core, one link at a time. It does not call any other subroutines and it uses common blocks CLDAT and CDAT2.

ix. Subroutine REFILE

This subroutine scans the original file of traffic links and sorts them according to the location of their midpoints. In the sorted file, all links whose midpoints fall in a given 3-km square are grouped together. The address of the first link of the sequence for each square and the number of links whose midpoints fall in that square are retained. Figure A-2 is a simplified flowchart for this subroutine. REFILE calls no subroutines other than those required for writing random access files (a system routine that differs for IBM and CDC versions). The common blocks LINDEX, INOUTS, and ODDEND are used.

x. Subroutine SECOND

This subroutine is used to estimate the secondary traffic in each grid square from the information provided for each link in the primary traffic file. The total (primary plus secondary) traffic for the entire area is also used to make the secondary traffic estimates. Common block QUSTN1 is used; SECOND calls the subroutine GRID.

xi. Subroutine BIGLNK

This subroutine is called by the main program if the link file reduction option is exercised. It sorts through the primary traffic link file and determines which links carry the largest traffic columes. The number of links that BIGLNK will retain in the primary file is either input by the user or, if a VMT minimum is input instead, is 1500. BIGLNK puts the rest of the link emissions into the secondary emission grid with subroutine SEXTOR. BIGLNK calls subroutines ZAVE, GETZ, and SEXTOR. It uses common blocks INOUTS, ODDEND, QUSTN1, QUSTN2, TFCSTF, and GG.

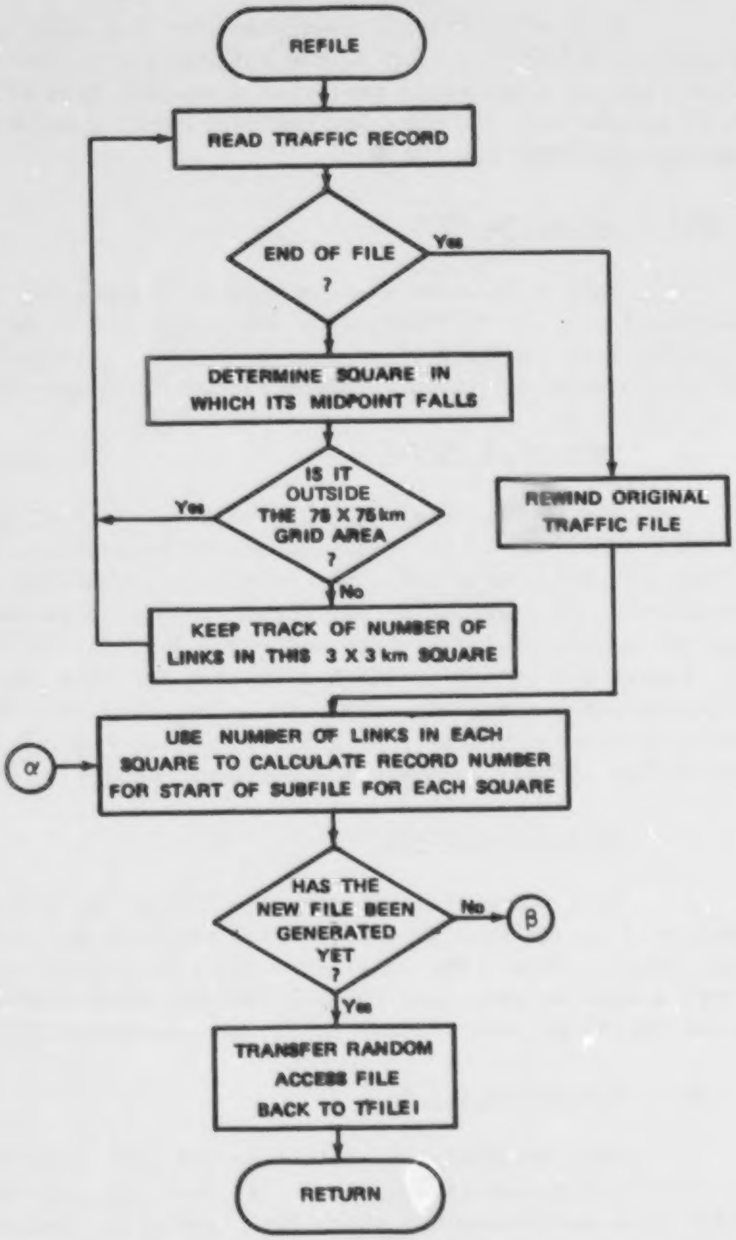
REFILE
READ TRAFFIC RECORD
END OF FILE ?
Yes
DETERMINE SQUARE IN WHICH ITS MIDPOINT FALLS
IS IT OUTSIDE THE 75 X 75 km GRID AREA ?
Yes
No
KEEP TRACK OF NUMBER OF LINKS IN THIS 3 X 3 km SQUARE
REWIND ORIGINAL TRAFFIC FILE
α
USE NUMBER OF LINKS IN EACH SQUARE TO CALCULATE RECORD NUMBER FOR START OF SUBFILE FOR EACH SQUARE
HAS THE NEW FILE BEEN GENERATED YET ?
No
β
Yes
TRANSFER RANDOM ACCESS FILE BACK TO TFILE1
RETURN

FIGURE A-2 SIMPLIFIED FLOW CHART FOR SUBROUTINE REFILE

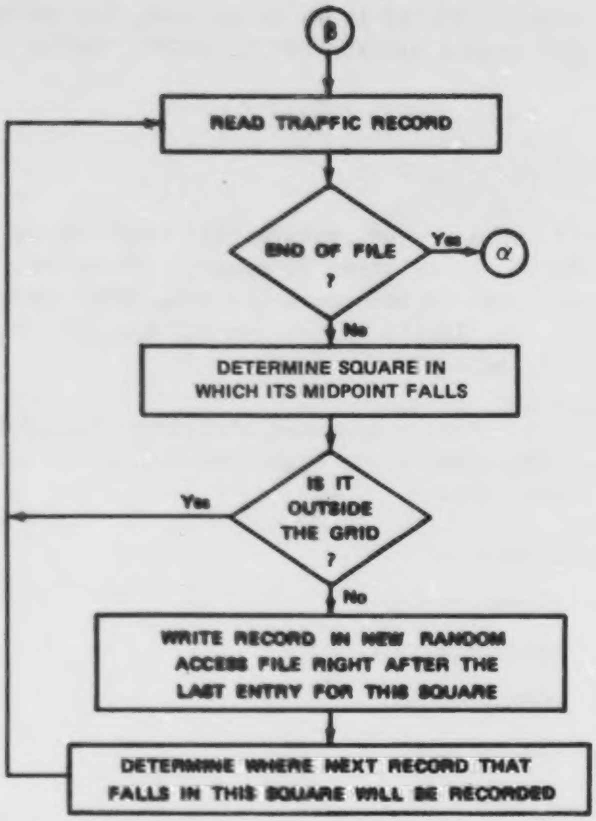
β
READ TRAFFIC RECORD
END OF FILE ?
Yes
α
No
DETERMINE SQUARE IN WHICH ITS MIDPOINT FALLS
IS IT OUTSIDE THE GRID ?
Yes
No
WRITE RECORD IN NEW RANDOM ACCESS FILE RIGHT AFTER THE LAST ENTRY FOR THIS SQUARE
DETERMINE WHERE NEXT RECORD THAT FALLS IN THIS SQUARE WILL BE RECORDED

FIGURE A-2 SIMPLIFIED FLOW CHART FOR SUBROUTINE REFILE (Concluded)

xii. Subroutine SEXTOR

This subroutine is called if the link-file reduction option is used. It adds the emissions of links having VMT below the minimum to the emissions of the secondary network grid square through which the link passes. It calls subroutine GRID and uses common block GG.

c. The Diffusion Module

i. Subroutine DIFMOD

This subroutine controls the operation of the diffusion module. It calls DIFF to read the necessary input data and make most of the dispersion computations. It calls the controlling routine of the intersection model, INT, if it is to be used, and prints the output of APRAC-3. It uses common blocks INOUTS, CLINE, QUSTN1 and OVRLAY.

ii. Subroutine DIFF

This is the major routine that controls the reading of the inputs required for calculation of concentrations at the various receptors. The locations of receptors and wind monitoring sites are input through DIFF. The length of the run and the use of local models are defined by inputs to DIFF.

Figure A-3 is a somewhat simplified flowchart for the diffusion module. The subroutines required were listed earlier. The required common blocks are:

- COMMON/XY/
- COMMON/CSTAB/
- COMMON/DAYLYT/
- COMMON/QUSTN1/
- COMMON/HMM/
- COMMON/CLINE/
- COMMON/ODDEND/
- COMMON/INOUTS/
- COMMON/TFCSTF/
- COMMON/SFC/
- COMMON/MIX/
- COMMON/DIMINT/
- COMMON/CFAC/
- COMMON/QUSTN2/
- COMMON/OVRLAY/

iii. Subroutine BASIC

This subroutine calculates constants and geometric quantities used in other parts of the diffusion module. The values are stored in the labeled common ALIC. No subroutines are used.

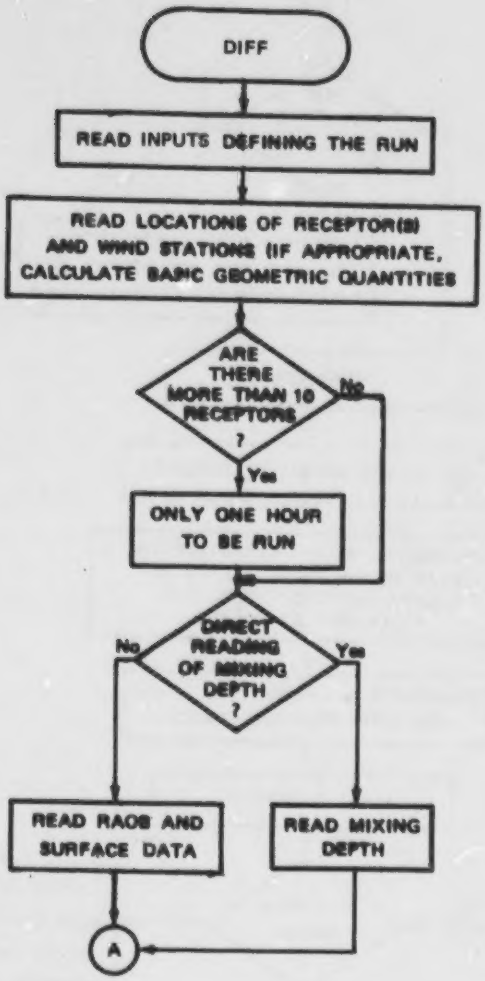
DIFF
READ INPUTS DEFINING THE RUN
READ LOCATIONS OF RECEPTOR(S) AND WIND STATIONS (IF APPROPRIATE, CALCULATE BASIC GEOMETRIC QUANTITIES
ARE THERE MORE THAN 10 RECEPTORS ?
No
Yes
ONLY ONE HOUR TO BE RUN
DIRECT READING OF MIXING DEPTH ?
No
Yes
READ RAOB AND SURFACE DATA
READ MIXING DEPTH
A

FIGURE A-3 SIMPLIFIED FLOW CHART FOR DIFF

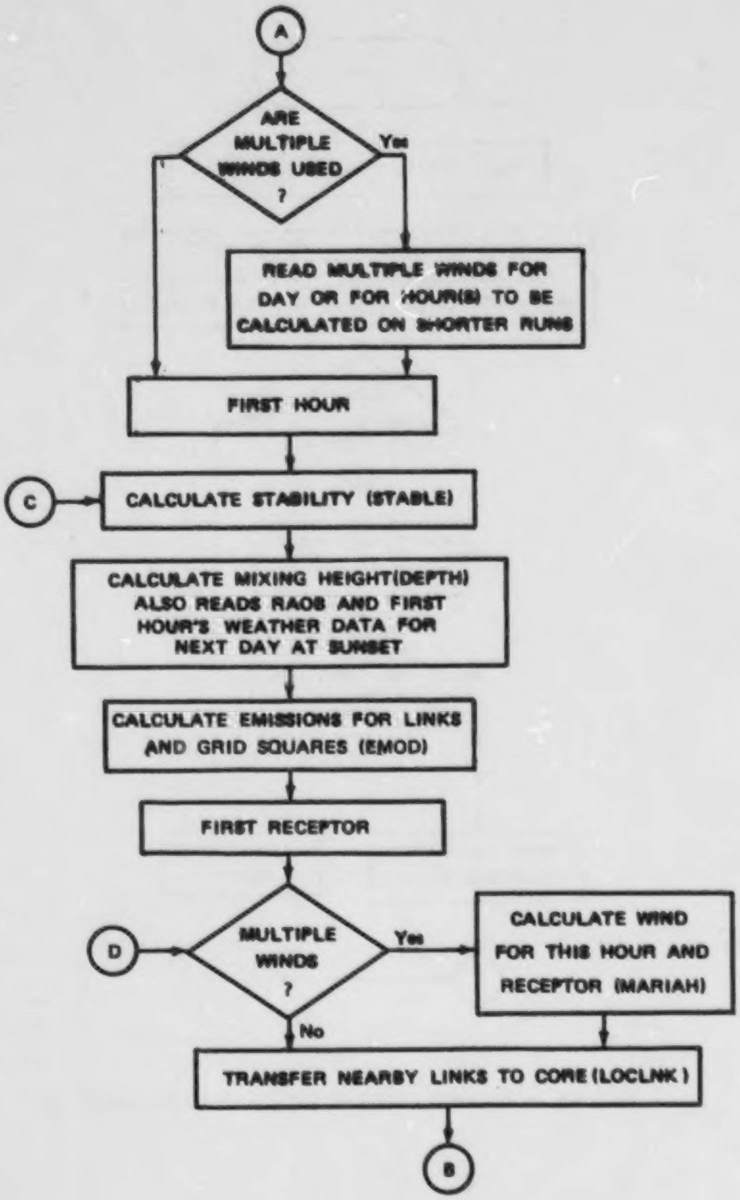
A
ARE MULTIPLE WINDS USED ?
Yes
READ MULTIPLE WINDS FOR DAY OR FOR HOUR(S) TO BE CALCULATED ON SHORTER RUNS
FIRST HOUR
C
CALCULATE STABILITY (STABLE)
CALCULATE MIXING HEIGHT(DEPTH) ALSO READS RAOB AND FIRST HOUR'S WEATHER DATA FOR NEXT DAY AT SUNSET
CALCULATE EMISSIONS FOR LINKS AND GRID SQUARES (EMOD)
FIRST RECEPTOR
D
MULTIPLE WINDS ?
Yes
CALCULATE WIND FOR THIS HOUR AND RECEPTOR (MARIAH)
No
TRANSFER NEARBY LINKS TO CORE (LOCLNK)
B

FIGURE A-3 SIMPLIFIED FLOW CHART FOR DIFF (Continued)

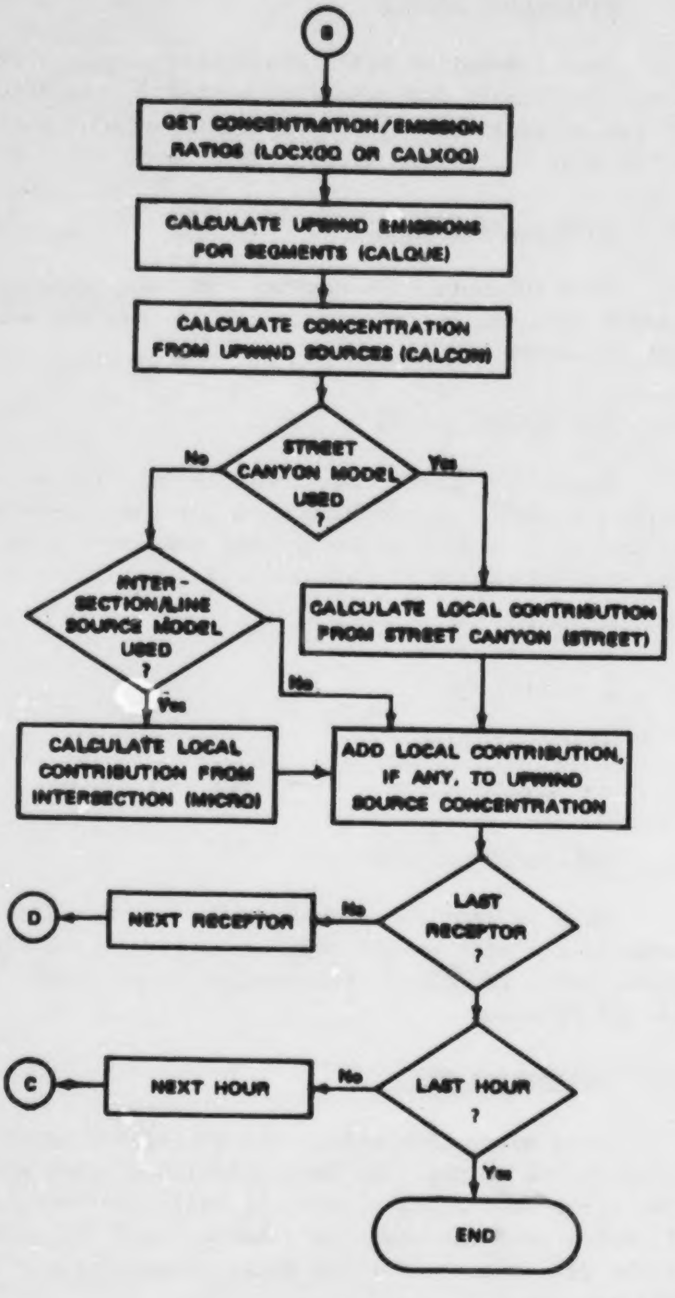
B
GET CONCENTRATION/EMISSION RATIOS (LOCXQQ OR CALXQQ)
CALCULATE UPWIND EMISSIONS FOR SEGMENTS (CALQUE)
CALCULATE CONCENTRATION FROM UPWIND SOURCES (CALCON)
STREET CANYON MODEL USED ?
No
Yes
INTER-SECTION/LINE SOURCE MODEL USED ?
CALCULATE LOCAL CONTRIBUTION FROM STREET CANYON (STREET)
No
Yes
CALCULATE LOCAL CONTRIBUTION FROM INTERSECTION (MICRO)
ADD LOCAL CONTRIBUTION, IF ANY, TO UPWIND SOURCE CONCENTRATION
D
NEXT RECEPTOR
No
LAST RECEPTOR ?
C
NEXT HOUR
No
LAST HOUR ?
Yes
END

FIGURE A-3 SIMPLIFIED FLOW CHART FOR DIFF (Concluded)

iv. Subroutine CALCON

This subroutine calculates concentrations from other than local sources. Previously determined concentration/emission ratios for each segment are multiplied by the appropriate segment emission rates and summed. It uses the common blocks QUSTN1 and QUE.

v. Subroutine CALLOC

This subroutine determines emission rates in outer segments from the gridded emission rates. It is called from the subroutine CALQUE. The common blocks GRDEMS, QUE, and ALLC are used.

vi. Subroutine CALQUE

This subroutine determines the emission rates for each upwind segment. Stored link data are used for the segments within 2 km. CALLOC is called to determine outer segment emissions from gridded data. The following labeled common blocks are used:

- COMMON/CSTM/
- COMMON/QUE/
- COMMON/CLDAT/
- COMMON/ALLC/ .

vii. Subroutine CALXOQ

This subroutine calculates the concentration/emission ratio for each of the nine upwind segments according to the appropriate Gaussian or box model formulae, as described in the text. The labeled common block QUE is used.

viii. Subroutine DEPTH

This subroutine calculates the mixing depth for the hour, using the temperature or the time interpolation schemes described in the text. At the first hour after sunset, it calls the subroutines RAOBHM and SFCOBS1, which read the next day's header card and radiosonde observations and the first hour's weather data, respectively. The following common blocks are used:

- COMMON/DEEPTH/
- COMMON/INOUTS/

- COMMON/DAY/
- COMMON/MIX/
- COMMON/HMM/
- COMMON/SFC/ .

ix. Subroutine LOCLNK

This subroutine transfers traffic link data from nearby grid squares to core storage from random access disk storage. The common blocks CLDAT and LINDEX are used.

x. Subroutine MARIAH

This subroutine interpolates winds for a given receptor from the multiple wind measurements that have been input. The interpolation method is based on that suggested by Heffter and Taylor (1975). It has been described in the text. A flowchart for MARIAH is shown in Figure A-4. It uses no subroutines or common blocks.

xi. Function NDAYWK

This routine is based on the program described by Binowski (1974). It determines the day of the week for any date in the twentieth century. It requires no subroutines or common blocks.

xii. Function NSEAS

The function NSEAS gives the season, based on the date. Season 1 is winter (December through February); season 2 is spring, and so forth. No subroutines or commons are used with this function.

xiii. Subroutine RAOBHM

This subroutine reads the header card that gives date, maximum and minimum temperature, and local time indicator. It also reads the radiosonde data. From this information, the maximum and minimum mixing heights for the coming day are calculated. No other subroutines are used with RAOBHM. The following common blocks are required:

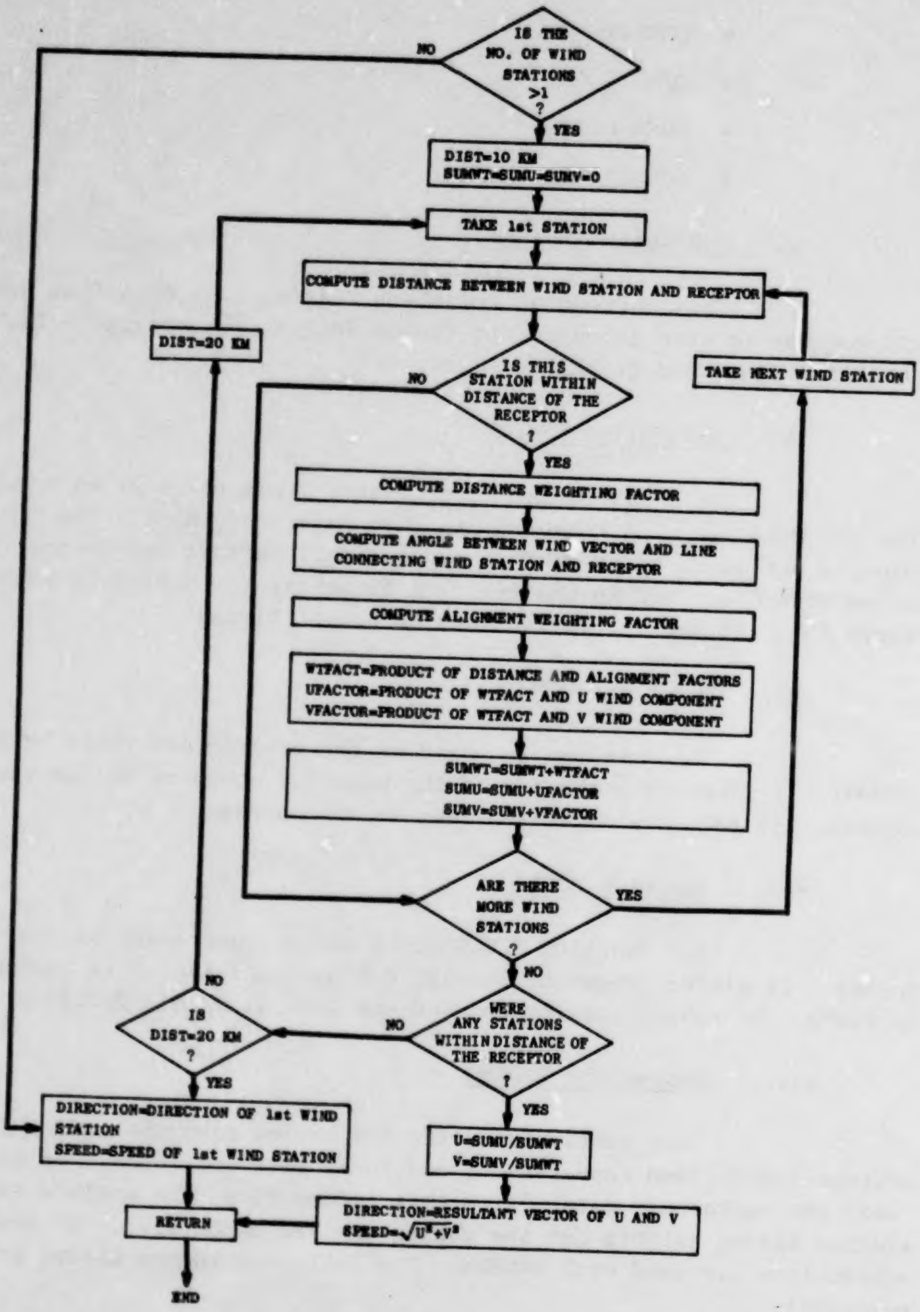
IS THE NO. OF WIND STATIONS >1 ?
NO
YES
DIST=10 KM
SUMWT=SUMU=SUMV=0
TAKE 1st STATION
COMPUTE DISTANCE BETWEEN WIND STATION AND RECEPTOR
DIST=20 KM
TAKE NEXT WIND STATION
IS THIS STATION WITHIN DISTANCE OF THE RECEPTOR ?
NO
YES
COMPUTE DISTANCE WEIGHTING FACTOR
COMPUTE ANGLE BETWEEN WIND VECTOR AND LINE CONNECTING WIND STATION AND RECEPTOR
COMPUTE ALIGNMENT WEIGHTING FACTOR
WTFACT=PRODUCT OF DISTANCE AND ALIGNMENT FACTORS
UFACTOR=PRODUCT OF WTFACT AND U WIND COMPONENT
VFACTOR=PRODUCT OF WTFACT AND V WIND COMPONENT
SUMWT=SUMWT+WTFACT
SUMU=SUMU+UFACTOR
SUMV=SUMV+VFACTOR
ARE THERE MORE WIND STATIONS ?
YES
NO
NO
IS DIST=20 KM ?
NO
WERE ANY STATIONS WITHIN DISTANCE OF THE RECEPTOR ?
YES
YES
DIRECTION=DIRECTION OF 1st WIND STATION
SPEED=SPEED OF 1st WIND STATION
U=SUMU/SUMWT
V=SUMV/SUMWT
RETURN
DIRECTION=RESULTANT VECTOR OF U AND V
SPEED=$\sqrt{U^2+V^2}$
END

FIGURE A-4 FLOW CHART FOR SUBROUTINE MARIAH

- COMMON/INOUTS/
- COMMON/QUSTN1/
- COMMON/MIX/
- COMMON/SFC/
- COMMON/HMM/ .

xiv. Subroutines SFCOB1 and SFCOB2

These two subroutines read the surface weather data. Subroutine SFCOB1 reads only the first hour of the day. For 24-hour runs, it is called from the subroutine DEPTH at the first hour after sunset. Subroutine SFCOB2 is called at the beginning of the run, after SFCOB1, and it reads the data for the remainder of the day. Neither routine calls any other subroutines. They both use the common SFC. In addition, SFCOB2 uses the common QUSTN1.

xv. Subroutine STABLE

This subroutine defines the atmospheric stability category for the hour. The method described by Ludwig and Dabberdt (1976) is used to derive the stability from wind speed, cloud cover, date, station latitude, and time of day. This routine determines solar elevation angle for purposes of estimating insolation strength and defining the first hour after sunset. No subroutines are called. The common blocks listed below are used:

- COMMON/DEEPTH/
- COMMON/CSTAB/
- COMMON/HMM/
- COMMON/MIX/
- COMMON/SFC/ .

xvi. Subroutine WDBAR

This subroutine is used to provide an average wind direction based on the multiple wind observations when they are available. This average direction is then used at any receptor where the average speed (from MARIAH) might be zero. This subroutine requires no subroutines or labeled common blocks.

d. Local Source Routines

i. Subroutine STREET

This subroutine calculates the contribution of emissions within a local street canyon to the total observed concentrations. The empirical model used to do this is described in the text (see Figure 6). No subroutines or labeled common blocks are used.

ii. Intersection/Line-Source Model Subroutines

Several subroutines are used to make the calculations necessary to determine the effects of intersection traffic on local pollutant concentrations. The first two subroutines listed below (INPTMI and RETRAF) are called from INT and are used to read the necessary traffic information. Subroutine PICKIT, discussed next, is called from EMOD. Subroutine INT is the controlling routine for the calculations. Unless intersection effects are to be determined, it will not be necessary to use the subroutines described in this section.

1) Subroutines RETRAF and INPTMI--As noted above, these two routines are called from INT when the intersection model is to be used. The RETRAF routine reads the necessary intersection information for each hour to be treated. This information is then stored on disk for subsequent reading on an hour-by-hour basis with the other routine, INPTMI. The common blocks used by RETRAF are DIMINT and QUSTN1; those used by INPTMI are INSECT, TRAF, and XY.

2) Subroutine PICKIT--This subroutine is called from EMOD when the intersection/line source model is to be used. As the traffic file is scanned, PICKIT identifies the traffic links at the intersection. The routine uses the labeled common blocks DIMINT and EMIT.

3) Subroutine INT--As noted before, this subroutine controls the calling of the intersection flow model (INSEC), the intersection emissions model (EMITX) and the finite line-source model (LINE). It uses the following labeled common blocks:

- COMMON/CLINE/
- COMMON/TRAF/
- COMMON/XY/
- COMMON/RECEP/
- COMMON/OVRLAY/
- COMMON/QUSTN1/

4) Subroutine MODMOD--This subroutine calculates modal emission factors for use in EMITX. Emission factors are calculated for acceleration, deceleration, and cruise modes for hydrocarbons and carbon monoxide. MODMOD calls subroutines COEFFS, which supplies the modal emission coefficients, BASIS, which supplies the modal emission calculation equations, and DETERF, which supplies deterioration and update factors. MODMOD uses the following common blocks:

   - COMMON/MODAL/
   - COMMON/COEF/
   - COMMON/BASE/
   - COMMON/FACTS/
   - COMMON/COMING/ .

5) Subroutine EMITX--This subroutine calculates modal emission rates at an intersection. Emissions are determined for each of five different modes of operation: acceleration, steady cruise, deceleration, deceleration plus idling, and acceleration plus idling. EMITX calls subroutine MODMOD, the modal emissions model. The common blocks listed below are used:

   - COMMON/INSECT/
   - COMMON/TRAF/
   - COMMON/XY/
   - COMMON/MODAL/ .

6) Subroutine INSEC--This subroutine models the traffic behavior at the intersection. It computes delay and queue length based on the model described in the text. A flowchart of the subroutine is given in Figure A-5. The subroutine PLATON is called by INSEC. The labeled common blocks INSECT, TRAF, and XY are used.

7) Subroutine PLATON--The subroutine PLATON is used to calculate vehicle platoon arrivals at the intersection modeled in INSEC. It assumes that the upstream intersections behave the same as the modeled intersection, differing only in the relative arrival times of platoons. No other subroutines are called. This routine uses the same common blocks as INSEC: TRAF, XY, and INSECT.

8) Subroutine LINE--This subroutine calculates the concentration of pollutant at the receptor from a finite line source. The line source is approximated by a series of point sources. Figure A-6 is a flowchart for this subroutine. It also shows the subroutines called from LINE. These are:

- SUBROUTINE CURTR
- SUBROUTINE CONCAL
- SUBROUTINE SPACNG
- SUBROUTINE XSIGN .

These subroutines are briefly discussed in the following paragraphs. The commons required by LINE are: RECEP, XYCOOR, TRAF and SIGMAS.

The subroutine CURTR performs a coordinate transformation such that the y-axis in the new system is along the line source. The origin is located at the intersection of the wind vector passing through the receptor and the line source, or its extension. The common blocks COORTR, RECEP, and XYCOOR are used.

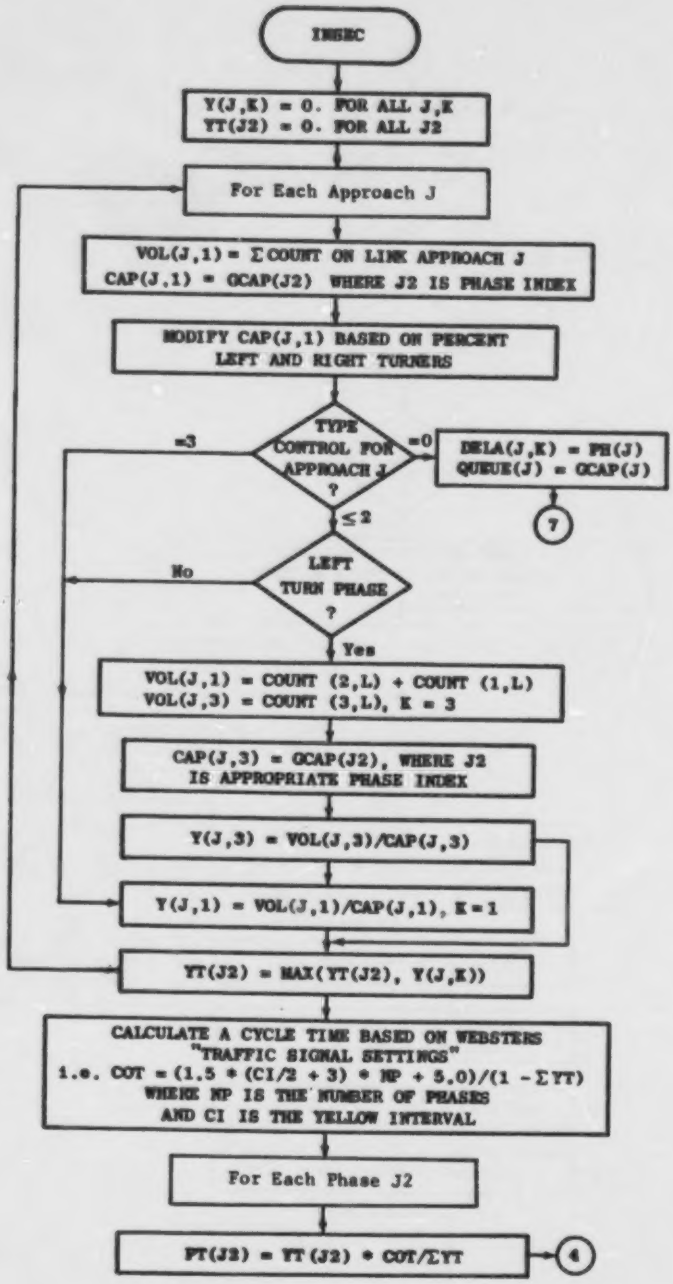
INSEC
Y(J,K) = 0. FOR ALL J,K
YT(J2) = 0. FOR ALL J2
For Each Approach J
VOL(J,1) = ΣCOUNT ON LINK APPROACH J
CAP(J,1) = GCAP(J2) WHERE J2 IS PHASE INDEX
MODIFY CAP(J,1) BASED ON PERCENT LEFT AND RIGHT TURNERS
TYPE CONTROL FOR APPROACH J ?
=3
=0
DELA(J,K) = PH(J)
QUEUE(J) = GCAP(J)
7
≤2
LEFT TURN PHASE ?
No
Yes
VOL(J,1) = COUNT (2,L) + COUNT (1,L)
VOL(J,3) = COUNT (3,L), K = 3
CAP(J,3) = GCAP(J2), WHERE J2 IS APPROPRIATE PHASE INDEX
Y(J,3) = VOL(J,3)/CAP(J,3)
Y(J,1) = VOL(J,1)/CAP(J,1), K = 1
YT(J2) = MAX(YT(J2), Y(J,K))
CALCULATE A CYCLE TIME BASED ON WEBSTERS "TRAFFIC SIGNAL SETTINGS"
i.e. COT = (1.5 * (CI/2 + 3) * NP + 5.0)/(1 - ΣYT)
WHERE NP IS THE NUMBER OF PHASES
AND CI IS THE YELLOW INTERVAL
For Each Phase J2
PT(J2) = YT(J2) * COT/ΣYT
4

FIGURE A-5 SIGNALIZED INTERSECTION MODEL FLOW DIAGRAM

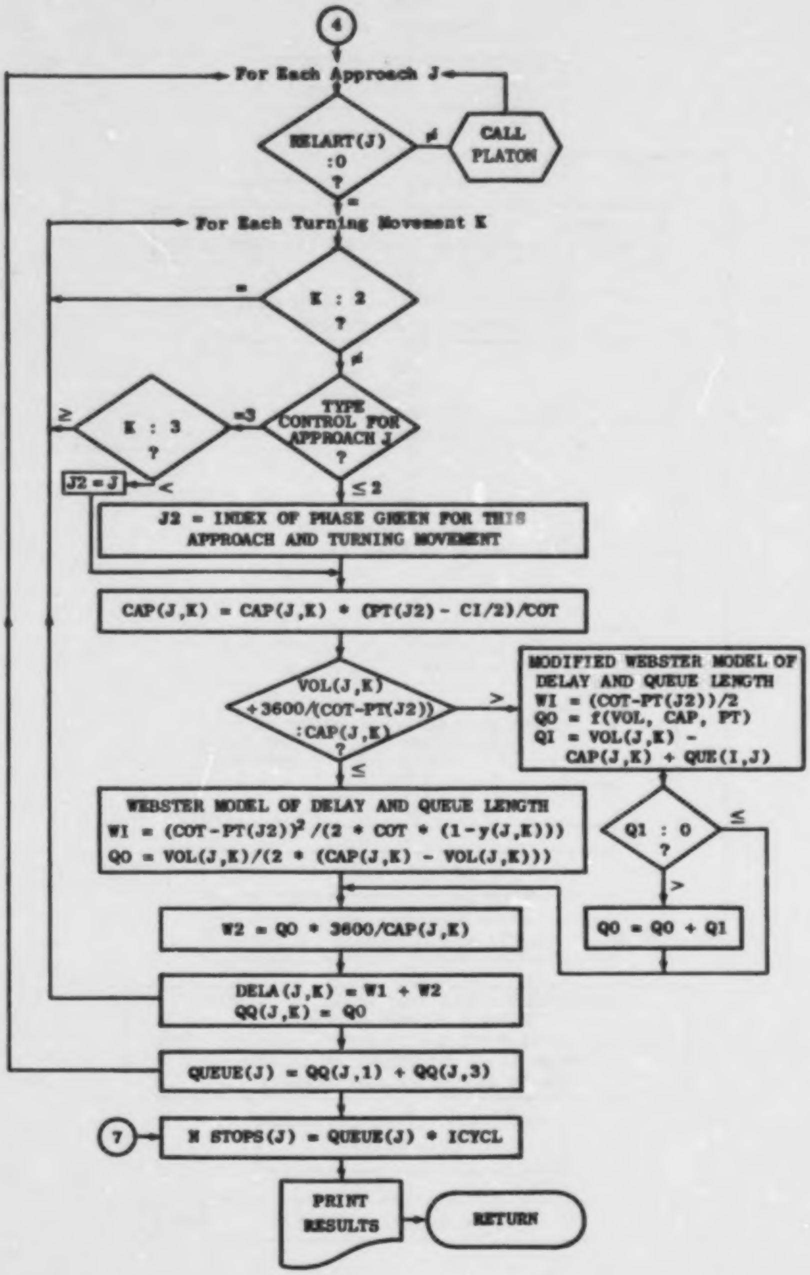
4
For Each Approach J
RELART(J) :0 ?
≠
CALL PLATON
=
For Each Turning Movement K
K : 2 ?
=
≠
TYPE CONTROL FOR APPROACH J ?
=3
K : 3 ?
≥
<
J2 = J
≤ 2
J2 = INDEX OF PHASE GREEN FOR THIS APPROACH AND TURNING MOVEMENT
CAP(J,K) = CAP(J,K) * (PT(J2) - CI/2)/COT
VOL(J,K) +3600/(COT-PT(J2)) :CAP(J,K) ?
>
≤
MODIFIED WEBSTER MODEL OF DELAY AND QUEUE LENGTH
WI = (COT-PT(J2))/2
QO = f(VOL, CAP, PT)
QI = VOL(J,K) - CAP(J,K) + QUE(I,J)
WEBSTER MODEL OF DELAY AND QUEUE LENGTH
WI = (COT-PT(J2))^2 /(2 * COT * (1-y(J,K)))
QO = VOL(J,K)/(2 * (CAP(J,K) - VOL(J,K)))
Q1 : 0 ?
≤
>
QO = QO + Q1
W2 = QO * 3600/CAP(J,K)
DELA(J,K) = W1 + W2
QQ(J,K) = QO
QUEUE(J) = QQ(J,1) + QQ(J,3)
7
N STOPS(J) = QUEUE(J) * ICYCL
PRINT RESULTS
RETURN

FIGURE A-5 SIGNALIZED INTERSECTION MODEL FLOW DIAGRAM (Concluded)

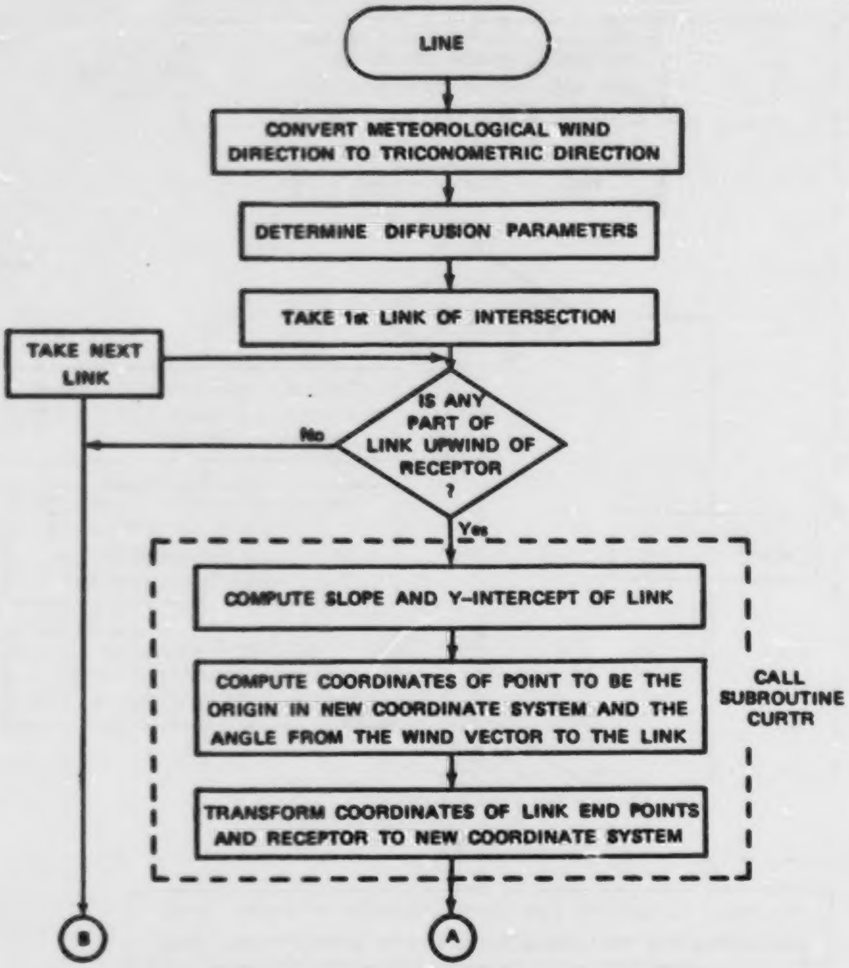
LINE
CONVERT METEOROLOGICAL WIND DIRECTION TO TRIGONOMETRIC DIRECTION
DETERMINE DIFFUSION PARAMETERS
TAKE 1st LINK OF INTERSECTION
TAKE NEXT LINK
IS ANY PART OF LINK UPWIND OF RECEPTOR ?
No
Yes
COMPUTE SLOPE AND Y–INTERCEPT OF LINK
COMPUTE COORDINATES OF POINT TO BE THE ORIGIN IN NEW COORDINATE SYSTEM AND THE ANGLE FROM THE WIND VECTOR TO THE LINK
TRANSFORM COORDINATES OF LINK END POINTS AND RECEPTOR TO NEW COORDINATE SYSTEM
CALL SUBROUTINE CURTR
B
A

FIGURE A-6 FLOW CHART OF SUBROUTINE LINE

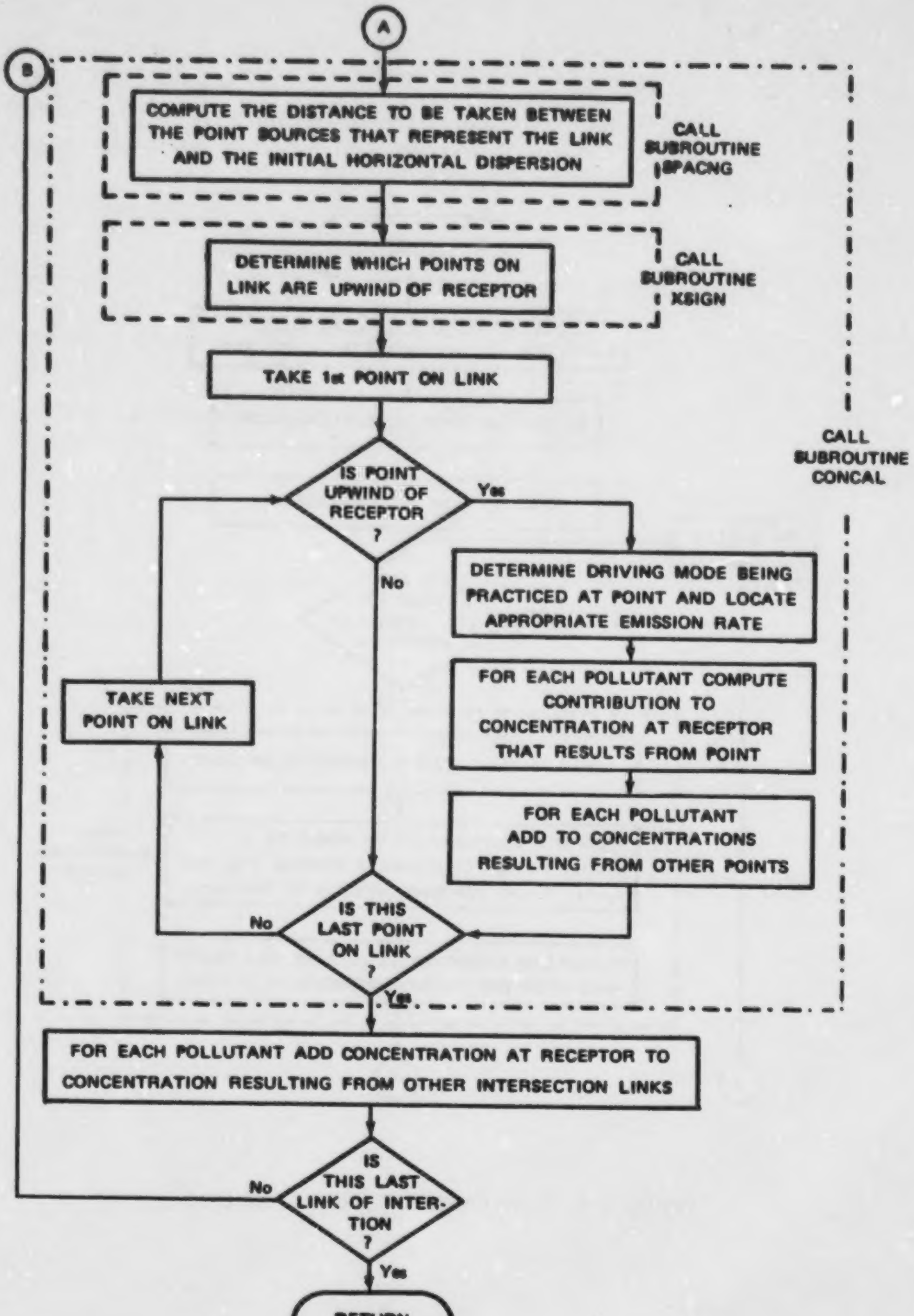
A
B
COMPUTE THE DISTANCE TO BE TAKEN BETWEEN THE POINT SOURCES THAT REPRESENT THE LINK AND THE INITIAL HORIZONTAL DISPERSION
CALL SUBROUTINE SPACNG
DETERMINE WHICH POINTS ON LINK ARE UPWIND OF RECEPTOR
CALL SUBROUTINE XSIGN
TAKE 1st POINT ON LINK
CALL SUBROUTINE CONCAL
IS POINT UPWIND OF RECEPTOR ?
Yes
No
DETERMINE DRIVING MODE BEING PRACTICED AT POINT AND LOCATE APPROPRIATE EMISSION RATE
FOR EACH POLLUTANT COMPUTE CONTRIBUTION TO CONCENTRATION AT RECEPTOR THAT RESULTS FROM POINT
FOR EACH POLLUTANT ADD TO CONCENTRATIONS RESULTING FROM OTHER POINTS
TAKE NEXT POINT ON LINK
IS THIS LAST POINT ON LINK ?
No
Yes
FOR EACH POLLUTANT ADD CONCENTRATION AT RECEPTOR TO CONCENTRATION RESULTING FROM OTHER INTERSECTION LINKS
IS THIS LAST LINK OF INTERSECTION ?
No
Yes
RETURN
END

FIGURE A-6 FLOW CHART OF SUBROUTINE LINE (Concluded)

The subroutine CONCAL calculates the concentration at the receptor from each point along the line source. It uses the common blocks RECEP, XYCOOR, SIGMAS, TRAF and COORTR.

The subroutine SPACNG is called by CONCAL. It determines the appropriate spacing of the point sources used to approximate the line source and also calculates the values of various parameters used in the subroutine CONCAL. It uses labeled commons SIGMAS, TRAF, and COORTR.

The subroutine XSIGN is called from CONCAL to determine which points on the line are upwind of the receptor and hence will contribute to the observed concentrations. It uses the following labeled commons: RECEP, XYCOOR and COORTR.

e. Program Listing

The following pages provide a complete listing of the FORTRAN-coded computer program. The version given here is suitable for use with a VAX machine. The changes necessary to run on IBM or UNIVAC, or on CDC equipment, are marked with comments.

```
      PROGRAM APRAC3
C  READS PRELIMINARY INPUTS, CALLS DIFFUSION OR EMISSION MODULES ETC.
C       BOBICK - - LUDWIG
C
      DIMENSION     LWFAC(5),DDD(19), X(2),Y(2),VOL(2),LINKID(2)
      COMMON/TFCSIF/ADJSPD(2,5,24),DEFCAP(2),DTRAF(2,12,24),DTRAF2(3,24)
     1,TRAF2(25,25),SPD(2,5),SEASON(4),EMIS(3,6,20), AVGSP2, TVMT2
      COMMON/ODDEND/NTLNK,IYEAR, IHOUR, IDAY,ISEA
      COMMON/SFC/IWD(24),WS(24),TCLD(24),ITEMP(24)
      COMMON/QUSTN1/YES,QPIN,QPGD1,QPGD2,QPGDT,QPFILE,QPOL(3),QAPRAC,QSE
     1C,QCAPR,QHRVOL,QFHWA,QSPD,ALT,CALIF,AREAID,QSTRT,QISMAP,QMIX
     2,NWIND,LCODE
      COMMON/INOUTS/NCARD1,NCARD,NCARD2,NCARDR,NOUT,TFILE0,TFILE1,TFILE2
     1,NCARDX,NCARDW,INPT,IDISK
      COMMON/GG/NGRIDE,NGRIDN,GSIZE,ORIGE,ORIGN,GVERT
      COMMON /QUSTN2/QBIG,VMTMIN,QRFILE,NCUT,MDIM
      INTEGER TFILE1,TFILE2,TFILE3,TFILE0,AREA,AR,FC
      REAL LENGTH,LWFAC,NO
      DATA NO/3HNO /
      DATA MORE/4HMORE/
      DATA DATA/4HDATA/
      IDISK=8
      INPT=5
      INTRF=5
      NCARD1=5
      NCARDW=5
      NCARDX=5
      NCARD=5
      NOUT=6
      NCARDR=5
      IOUT=6
      TFILE0=2
      TFILE1=11
      TFILE2=12
      TFILE3=13
      MDIM=1200
      READ(NCARD1,6001,END=10000) QPIN
10000 READ(NCARD1,6001,END=10001) QPGD1
10001 READ(NCARD1,6001,END=10002) QPGD2
10002 READ(NCARD1,6001,END=10003) QPGDT
10003 READ(NCARD1,6002,END=10004) QPFILE,QRFILE
10004 READ(NCARD1,6002,END=10005) QPOL(1),QPOL(2),QPOL(3)
10005 READ(NCARD1,6001,END=10006) QAPRAC
10006 READ(NCARD1,6017,END=10007) QSEC,QBIG,VMTMIN,NCUT
10007 READ(NCARD1,6001,END=10008) QCAPR
10008 READ(NCARD1,6001,END=10009) QHRVOL
10009 READ(NCARD1,6001,END=10010) QFHWA
10010 READ(NCARD1,6001,END=10011) QSPD
C       READING WHAT KINDS OF EMISSIONS
C       INPUTS AND OUTPUTS-YES OR NO
```

```
C     QPGD1,QPGD2,QPGDT=PRINT GRIDDED PRIMARY, SECONDARY,TOTAL
C     TRAFFIC EMISSION
C     QPFILE=PRINT TOTAL TRAFFIC FILE
C     QPOLIN=POLLUTANTS TO BE CONSIDERED
C              1=HC
C              2=CO
C              3=NOX
C     QAPRAC=DIFFUSION MODEL TO BE USED
C     QFHWA=FHWA FORMAT TRAFFIC INPUT
C     QSEC=AUTOMATIC CALCULATION OF SECONDARY TRAFFIC
C     QBIG = USE ONLY LARGEST VOLUME LINKS ( GRIDS OTHERS AS
C             SECONDARY TRAFFIC--SUBROUTINE SEXTOR)
C     VMTMIN = MINIMUM VOLUME FOR USED LINKS
C     NCUT   = MAXIMUM NUMBER OF LINKS TO BE USED
C
C     QCAPR=USE CAPACITY RESTRAINT TO COMPUTE SPEED
C     QHRVOL=HOURLY TRAFFIC VOLUMNE IS INPUT NOT ADT
C     QSPD=SPEED PROVIDED IN LINK DATA IS TO BE USED
C     READING DEFINITIONS OF THE AREA AND GRIDS
C     AREAID=NAME OF REGION, 5 LETTERS
C     ALT=HI OR LO FOR PURPOSES OF CALCULATING EMISSIONS
C     CALIF=CALIFORNIA OR NOT FOR PURPOSES OF CALCULATING EMISSIONS
C     NGRIDN, NGRIDE=NO. OF GRID SQUARES N-S AND E-W
C     NGRIDN AND NGRIDE MUST BE .LE. 25
C     GSIZE= GRID SQUARE DIMENSIONS-KM
C     IF QAPRAC=YES, GSIZE=3KM
C     ORIGE, ORIGIN=COORDINATES OF GRID ORIG
C     IN SAME UNITS AS USED TO DEFINE TRAFFIC LINK NODE LOCATIONS
C     GVERT=FACTOR TO CONVERT TRAFFIC LINK NODE UNITS TO GRID UNITS(KM).
C
10011 READ(NCARD1,6003,END=10012) AREAID
10012 READ(NCARD1,6001,END=10013) ALT
10013 READ(NCARD1,6001,END=10014) CALIF
10014 READ(NCARD1,6004,END=10015) NGRIDE,NGRIDN,GSIZE
10015 READ(NCARD1,6005,END=10016) ORIGE,ORIGN,GVERT
10016 IF(QPIN.EQ.YES)PRINT 7001,QPIN,QPGD1,QPGD2,QPGDT,QPFILE,QRFILE,
     1QPOL(1),QPOL(2),QPOL(3),QAPRAC,QSEC,QBIG,VMTMIN,NCUT,QCAPR,QHRVOL,
     3QFHWA,QSPD,AREAID,ALT,CALIF,GSIZE,NGRIDE,NGRIDN,ORIGE,ORIGN,GVERT
C
C     IF DIFFUSION MODEL TO BE USED, THEN GRIDSIZE WILL BE 3-KM
      IF(QAPRAC.EQ.YES) GSIZE=3.0
C
C     CHECK FOR USE OF LINK REDUCTION OPTION WITHOUT USE OF DIFFUSION MODEL
C
      IF(QAPRAC.EQ.YES .OR. QBIG.EQ.NO ) GO TO 10
      IF(QAPRAC.EQ.NO  .AND. QBIG.EQ.NO ) GO TO 10
      WRITE(IOUT,6020)
      GO TO 86
C
C     CHECK FOR TOO MANY GRID SQUARES
```

```
   10 IF(NGRIDN.LE.25 .AND. NGRIDE .LE. 25) GO TO 101
      WRITE(IOUT,6006)
      STOP
  101 CONTINUE
      IF(QFHWA.EQ.YES) QSPD=NO
C     READ HOURLY ADJ. FOR DIFF. PRIMARY TRAF. TYPES
C
      IF(QPIN.EQ.YES) PRINT 7003
      DO 50 J=1,12
      DO 50 I=1,2
      READ (INPT,6007,END=10017)(DTRAF(I,J,IHR),IHR=1,24)
10017 IF(QPIN.EQ.YES) PRINT 7002,I,J,(DTRAF(I,J,IHR),IHR=1,24)
   50 CONTINUE
      IF(QPIN.EQ.YES) PRINT 7004
      DO 60 I=1,3
C
C     READ HOURLY ADJUST. FOR SECONDARY TRAF.
C
      READ(INPT,6007,END=10018)(DTRAF2(I,IHR),IHR=1,24)
10018 IF(QPIN.EQ.YES) PRINT 7005,(DTRAF2(I,IHR),IHR=1,24)
   60 CONTINUE
C
C     READ SEASONAL TRAFFIC ADJUSTMENT
C
      READ(INPT,6007,END=10019)(SEASON(J),J=1,4)
C
C     READ AVER. SPEED(MPH) FOR SECONDARY TRAFFIC
C
10019 READ(INPT,6007,END=10020)AVGSP2
10020 IF(QPIN.EQ.YES) PRINT 7006,(SEASON(J),J=1,4),AVGSP2
C
C     READ AVERAGE SPEEDS FOR DIFF. TRAF. TYPES IF NOT TO BE
C     CALCULATED BY CAPACITY RESTRAINT.
C
      IF(QSPD.EQ.YES) GO TO 75
      READ(INPT,6008,END=10021)(SPD(1,LOCL),LOCL=1,5),(SPD(2,LOCL),LOCL=
     +1,5)
10021 IF(QPIN.EQ.YES) PRINT 7007,(SPD(1,LOCL),LOCL=1,5),(SPD(2,LOCL),LOC
     1L=1,5)
      IF(QCAPR.EQ.YES) GO TO 70
      DO 73 I=1,2
      DO 73 LOCL=1,5
C
C     FREE FLOW SPEEDS ASSUMED FOR OFF PEAK HOURS, SPEED ADJUSTMENT
C     FACTORS READ FOR OTHER HOURS.
C
      DO 65 IHR=1,5
   65 ADJSPD(I,LOCL,IHR)=1.0
      DO 66 IHR=22,24
   66 ADJSPD(I,LOCL,IHR)=1.0
```

```
10022 IF(QPIN.EQ.YES) PRINT 7002,I,LOCL,(ADJSPD(I,LOCL,IHR),IHR=6,21)
   73 CONTINUE
      GO TO 75
C
C     READ DEFAULT CAPACTTIES IF CAPACITY RESTRAINT USED
C
   70 READ(INPT,6008,END=10023)DEFCAP(1),DEFCAP(2)
10023 IF(QPIN.EQ.YES) PRINT 7008,DEFCAP(1),DEFCAP(2)
C
C     SECONDARY TRAFFIC CALCULATED(QSEC=YES) OR INPUT
C
   75 IF(QSEC.EQ.YES) GO TO 85
      READ(INPT,6008,END=10024)CLE
10024 IF(QPIN.EQ.YES) PRINT 7009,CLE
      DO 80 IY=1,NGRIDN
      READ(INPT,6013,END=10025) (TRAF2(IX,IY),IX=1,NGRIDE)
10025 IF(QPIN.EQ.YES) PRINT 7010,IY,(TRAF2(IX,IY),IX=1,NGRIDE)
   80 CONTINUE
      GO TO 90
C
C     READING INFO NECESSARY TO CALCULATE SECONDARY TRAFFIC.
C
   85 READ(INPT,6008,END=10026)(LWFAC(LOCL),LOCL=1,5)
10026 READ(INPT,6007,END=10027)TVMT
10027 IF(QPIN.EQ.YES) PRINT 7011,TVMT,(LWFAC(LOCL),LOCL=1,5)
   90 REWIND TFILE1
      SUMPT=0.0
      N=0
C
C     IS TRAFFIC IN FHWA FORMAT
C
      IF(QFHWA.EQ.YES) GO TO 125
C
C     READ IN NON-FHWA TRAFFIC
C
  100 READ(INTRF,6009,END=10028)X(1),Y(1),X(2),Y(2),TVOL,IFAC,LENGTH,LOC
     1L,CAP,SPEED
C
C     TERMINATE WITH A NUMBER IN COLUMN 1
C
10028 IF(X(1).GT.999999.) GO TO 175
      N=N+1
      VOL(1)=0.5*TVOL
      VOL(2)=VOL(1)
      LINKID(1)=0
      LINKID(2)=N
      LANDUS=0
      AREA=0
      LU=0
      AR=0
      GO TO 170
  125 SPEED=0.0
      PRINT 7017
  124 READ (TFILE0,6015,END=10029) (DDD(IDD), IDD=1,19)
10029 IF (QPIN .FQ. YES) PRINT 7015,(DDD(IDD), IDD=1,19)
C     CHECK FOR LAST HEADER RECORD
      IF ( DDD(2) .EQ.DATA) PRINT 7018
      IF (DDD(2) .EQ.DATA)  GO TO 130
      GO TO 124
C
C     READ FROM DECODED FHWA DATA FILE
C
C*******IBM*****************************************
  130  READ ( 2, 6016, END=175)LINKID(1),LINKID(2),X(1),Y(1),X(2),Y(2),
     1LENGTH,LANDUS,AREA,IFAC,VOL(1),VOL(2),CAP,LU,AR,FC
C*****************************************************************
C
C****************  CDC   ************************
C 130 READ(TFILE0,6016,END=10030) LINKID(1),LINKID(2),X(1),Y(1),X(2),Y(2
C    1),        LENGTH,LANDUS,AREA,IFAC,VOL(1),VOL(2),CAP,LU,AR,FC
C
C********CDC*****************************************
C0030 IF(EOF(TFILE0))C75,C6C,C75
C**************** ********************************
  161 N=N+1
C
C     COMPUTING LOCALE TYPE(LOCL) FROM AREA AND LAND USE
C
      IF(LANDUS .LT. 1) CALL ARELND(VOL,AREA,LANDUS)
      LOCL=5
      IF(LANDUS.NE.3) GO TO 150
      LOCL=4
      GO TO 170
  150 IF(LANDUS.NE.2) GO TO 152
      LOCL=3
C     GO TO 160
  152 IF(LANDUS.NE.1) GO TO 170
      IF(AREA.EQ.1) GO TO 154
      IF(AREA.EQ.2.OR.AREA.EQ.3) LOCL=2
      GO TO 170
  154 LOCL=1
C
C     CONVERTING TO METRIC UNITS(KM.)
C
  170 DO 172 I=1,2
      X(I)=(X(I)-ORIGE)*GVERT
      Y(I)=(Y(I)-ORIGN)*GVERT
  172 CONTINUE
      SUMPT=SUMPT+(VOL(1)+VOL(2))*LENGTH
      IF (QFHWA .NE. YES ) VOL(2)=SPEED
     1ANDUS,AREA,IFAC,VOL(1),VOL(2),CAP,LOCL,LU,AR,FC
      IF(QFHWA.EQ.YES) GO TO 130
      GO TO 100
  175 REWIND TFILE1
      NTLNK=N
C
C     GETTING SECONDARY TRAFFIC
C
      IF(QSEC.EQ.YES) GO TO 285
  180 SUM=0.0
      TVMT2=CLE*SUMPT*0.01
      DO 250 I=1,NGRIDE
      DO 250 J=1,NGRIDN
      SUM=SUM+TRAF2(I,J)
  250 CONTINUE
      DO 275 I=1,NGRIDE
      DO 275 J=1,NGRIDN
      TRAF2(I,J)=TRAF2(I,J)/SUM
  275 CONTINUE
      GO TO 290
  285 TVMT2 = TVMT-SUMPT
      IF (TVMT2 .GE. 0.) GO TO 287
      PRINT 6011, SUMPT
      STOP
  287 CALL SECOND(TRAF2,NGRIDE,NGRIDN,      LWFAC,GSIZE,TFILE1,NTLNK)
  290 CALL CALALT(ALT,CALIF,LCODE)
  300 IF(QAPRAC.EQ.YES) GO TO 400
  310 READ(INPT,6012,END=10031)IYEAR,ISEA,IDAY,IHOUR,TEMP, NDIT
10031 IF(QPIN.EQ.YES) PRINT 7012,IYEAR,IHOUR,IDAY,ISEA,TEMP, NDIT
      ITEMP(IHOUR)=TEMP+0.5
   89 CONTINUE
      CALL EMOD
      IF( NDIT.EQ.MORE) GO TO 310
      GO TO 86
  400 IF(QBIG.NE.YES) GO TO 410
      CALL BIGLNK
      GO TO 420
  410 CALL REFILE
  420 CALL DIFMOD
C***********************************************************
C 400 IF(QBIG.NE.YES) GO TO 410
C     CALL BIGLNK
C     GO TO 420
C 410 CALL REFILE
C 420 CALL DIFMOD
   86 CONTINUE
C     FORMATS
C
 6001 FORMAT(BZ,50X,A3)
 6002 FORMAT(BZ,50X,A3,7X,A3,7X,A3)
```

```
6004 FORMAT(BZ,50X,I3,7X,I3,7X,F10.2)
6005 FORMAT(BZ,50X,3F10.3)
6006 FORMAT(1H1,35H TOO MANY GRID SQUARES, RUN HALTED  )
6007 FORMAT(BZ,8F10.0)
6008 FORMAT(BZ,10F8.0)
6009 FORMAT(BZ,5F8.0,7X,I1,F8.0,7X,I1,2F8.0)
6010 FORMAT(2I5,4F8.4,F5.2,3I1,3F8.0,1X,4I1)
6011 FORMAT(1H1,69HPRIMARY TRAFFIC EXCEEDS TOTAL TRAFFIC--RUN STOPPED--
    1TOTAL PRIM. TFC = , E12.3)
6012 FORMAT(BZ,4I4,F8.0,6X,A4)
6013 FORMAT(BZ,5X,25F3.0)
6014 FORMAT(BZ,16F5.0)
6015 FORMAT (BZ,A1,17A4,A1)
6016 FORMAT (BZ,2I5, 4F8.0, F4.2, 3I1, 2F6.0, F5.0, 1X, 3I1)
6017 FORMAT(BZ,50X,A3,2X,A3,2X,F10.0,2X,I4)
6020 FORMAT(1H1,64HLINK REDUCTION OPTION SHOULD NOT BE USED WITHOUT DIF
    1FUSION MODEL)
7001 FORMAT(18H1   PRINT INPUTS-  ,A3/65H    PRIMARY, SECONDARY, AND/OR
    1 TOTAL TRAFFIC GRIDS TO BE PRINTED- ,A3,2H, ,A3,2H, ,A3/27H    PRI
    2NT LINK FILE-BEFORE  ,A3/26H    PRINT LINK FILE-AFTER ,A3/
    337H    POLLUTANTS TO BE CONSIDERED- HC,  ,A3,
    47H - CO,  ,A3,8H - NOX,  ,A3/32H    DIFFUSION MODEL TO BE USED-  ,
    5A3/48H    AUTOMATIC COMPUTATION OF SECONDARY TRAFFIC-  ,A3/
    631H    ONLY BIG LINKS CONSIDERED  ,A3/
    629H    MINIMUM VOLUME INCLUDED  ,F11.1/
    629H    MAXIMUM LINKS INCLUDED  ,,I10/
    6 10H    SPEEDS,
    6 27H FROM CAPACITY RESTRAINT-  ,A3/54H    HOURLY TRAFFIC VOLUMES U
    7 SED (AS OPPOSED TO ADT) -  ,A3/18H    FHWA TRAFFIC-  ,A3/39H    S
    8PEED SPECIFIED FOR NON-FHWA DATA-  ,A3/9H    AREA  ,A5,4H IS ,A2,2
    90H ALTITUDE---CALIF.=  ,A3/1H ,F10.3,17H-KM. SQ. GRIDS--  ,I3,21H
    1IN E-W DIRECTION AND ,I3,5H N-S /37H    THE ORIGIN OF THE GRID SYS
    2TEM IS  ,F10.3,1H,,F10.3,40H(0.01 MILE UNITS--TRAFFIC COORD. SYSTE
    3M) /45H    TO CONVERT 0.01-MILE TO KM., MULTIPLY BY  ,F10.6)
7002 FORMAT(14H0    DIRECTION  ,I2,16H,LOCATION CODE = ,I2,13H,FRACTION
    1/HR ,8F8.4/47X,8F8.4/47X,8F8.4)
7003 FORMAT(36H0  DIURNAL TRAFFIC CYCLES, PRIMARY-- )
7004 FORMAT(//42H0   SECONDARY--WEEKDAY, SATURDAY, SUNDAY-- )
7005 FORMAT(1H0,46X,8F8.4/47X,8F8.4/47X,8F8.4)
7006 FORMAT(55H0   SEASONAL ADJUSTMENTS (WINTER, SPRING, SUMMER, FALL)
    2 ,4F8.4/43H   AVG. SPEED (MPH) OF SECONDARY TRAFFIC = ,F8.3)
7007 FORMAT(35H0   BASIC FREEWAY SPEEDS--5 LOCALES ,5F8.1/35H       NON-
    1FREEWAY SPEEDS--5-LOCALES ,5F8.1/30H0   HOURLY SPEED ADJUSTMENTS--
    2 )
7008 FORMAT(61H0   DEFAULT CAPACITIES (VEHICLE/HR)--FREEWAY AND NON-FRE
    1EWAY, ,2F8.0)
7009 FORMAT(22H    SECONDARY TRAFFIC= ,F8.1,28H PERCENT OF PRIMARY TRAF
    1FIC. /92H0   PERCENTAGES OF EACH GRID (ROWS LISTED S TO N, COLUMNS
    2 W TO E) OCCUPIED BY SEC. STREETS-- //)
7010 FORMAT (5H ROW  ,I2,2X,25F4.0)
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     1EREST)=,F11.0//104H    RELATIVE SECONDARY TRAFFIC BY LOCALE (CBD,
     2SUBURB/CORE CITY COMMERCIAL, RESIDENT., INDUST., RURAL)-- /38X,F8.
     31,6X,F8.1,15X,F8.1,2X,2F8.1)
7012 FORMAT(21H    GRIDDED EMISSIONS ,I5,1H, ,I3,13H00 LOC. TIME, ,I2,1
     15HTH DAY OF WEEK ,I2,17HTH SEASON, TEMP.= ,F4.0,7H DEG. F ,3X,A4)
7015 FORMAT (3H    ,A1,19A4,A3)
7017 FORMAT (30H1  TRAFFIC HEADER INFORMATION  /)
7018 FORMAT (14H0  END HEADER  /1H1)
      STOP
      END
      BLOCK DATA
      COMMON /DAYLYT/ LOCDHR, LOCTYM
      COMMON/QUSTN1/YES,QPIN,QPGD1,QPGD2,QPGDT,QPFILE,QPOL(3),QAPRAC,QSE
     1C,QCAPR,QHRVOL,QFHWA,QSPD,ALT,CALIF,AREAID,QSTRT,QISMAP,QMIX
     2,NWIND,LCODE
      COMMON /INSECT/ITYPC,ICYCL,IFLAG,CI,TP,W1,NS,VOL(4,3),PH(4),GCAP(4
     1),RELART(4),NAL(4),DELA(4,3),DELAI(8),QQ(4,3),PT(4,3),Y(4,3),CAP(4
     2,3),YT(4),QUEUE(4),COUNT(4,4)   ,NSTOPS(4),PFRAC(4)
C**********IBM*********************************
C     REAL YES/3HYES/
C     REAL COUNT/16*0.0/
C***********************************************************************
C
C**********CDC*********************************
      DATA YES/3HYES/
      DATA COUNT/16*0.0/
C***********************************************************************
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE GRID(XX1,YY1,XX2,YY2,GSIZE,NSQ,IX,JY,FF)
C
C     THIS ROUTINE DETERMINES THE GRID SQUARES THROUGH WHICH A LINE SEG-
C     MENT PASSESAND THE FRACTION THAT FALLS WITHIN EACH SQUARE.
C     ---MANCUSO
C     XX1,YY1,XX2,Y2=COORD. OF LINE SEG. END POINTS
C     GSIZE=GRID SIZE
C     NSQ=NO. OF SQUARES THROUGH WHICH LINE SEG. PASSES
C     IX(L),JY(L)=INDICES OF THE LTH SQUARE THROUGH WHICH SEG. PASSES.
C     FF(L)=FRACTION OF TOTAL LINE SEGMENT WITHIN LTH SQUARE.
C
      DIMENSION IX(50), JY(50), FF(50)
      DIMENSION XI(26),YI(26),XJ(26),YJ(26),XR(50),YR(50)
      DATA V1,V26,N50,EXT/1.0,26.0,50,0.00000133/
      NSQ=0
      SI=1.0/GSIZE
C
C       CONVERT TO GRID UNITS
C
      X1=XX1*SI+1.0
      X2=XX2*SI+1.0
      Y1=YY1*SI+1.0
      Y2=YY2*SI+1.0
C
C       REVERSE LINK ENDS IF NECESSARY SO THAT X2 IS GT THAN X1
C
      IF (X2-X1) 16,18,20
   16 XS=X2
      X2=X1
      X1=XS
      YS=Y2
      Y2=Y1
      Y1=YS
      GO TO 20
   18 X2=X2+EXT
C
C       BASIC COMPUTATIONS
C
   20 IF(Y2 .EQ. Y1) Y2=Y2+EXT
      IX1=X1
      IX2=X2
      JY1=Y1
      JY2=Y2
      DX=X2-X1
      DY=Y2-Y1+EXT
      DYX=DY/DX
      DXY=DX/DY
      DLI=1.0/DX
      IF (DX.LT.0.1 .AND. DX.LT.ABS(DY))DLI=1.0/ABS(DY)
      JDIR=1
      Y0=Y1
      Y9=Y2
      IF (Y1.LE.Y2)GO TO 21
      Y0=Y2
      Y9=Y1
C
C        DEFININE NEW LINK THAT INCLUDES ONLY THAT PART THAT FALLS WITHIN
C        THE GRID BOUNDARIES (25X25). WHEN NONE OF THE LINK IS INSIDE THE
C        GRID THE ROUTINE RETURNS.
C
   21 IF (X1.LT.V1) GO TO 222
      IF (X1.GT.V26) GO TO 100
      GO TO 22
  222 AX=V1
      IF (AX.GT.X2) AX=X2
      Y1=Y1+(AX-X1)*DYX
      X1=AX
   22 IF (X2 .GT. V26) GO TO 23
      IF (X2.LT.V1)  GO TO 100
      GO TO 24
   23 Y2=Y2+(V26-X2)*DYX
      X2=V26
   24 IF (Y1.LT.V1) GO TO 224
      IF (Y1.LE.V26) GO TO 26
      IF (Y2.GT.V26) GO TO 100
      AY=V26
      GO TO 226
  224 IF (Y2.LT.V1) GO TO 100
      AY=V1
  226 X1=X1+(AY-Y1)*DXY
      Y1=AY
   26 IF (Y2.GE.V1.AND.Y2.LE.V26)GO TO 28
      AY=V1
      IF(Y2.GT.V1)AY=V26
      X2=X2 + (AY-Y2)*DXY
      Y2=AY
C
C       COMPUTE NSQ (NO. OF GRID SQUARES THROUGH THE LINK PASSES),AND
C       THE IX, IY AND FF VALUES(INDICES AND FRACTIONS WIYHIN THE SQUARES
C
   28 IS=0
      DO 40I=IX1,IX2
      X3=I
      IF (X3.LT.X1.OR.X3.GT.X2)GO TO 40
      IS=IS+1
      XI(IS)=X3
      YI(IS)=Y1+(X3-X1)*DYX
   40 CONTINUE
      IST=IS
      JS=0
   42 Y3=J
      IF (Y3.LT.Y0.OR.Y3.GT.Y9)GO TO 43
      JS=JS+1
      YJ(JS)=Y3
      XJ(JS)=X1+(Y3-Y1)*DXY
   43 J=J+JDIR
      IF (JDIR.LT.0)GO TO 44
      IF (J.LE.JY2) GO TO 42
      GO TO 45
   44 IF (J.GE.JY2)GO TO 42
   45 CONTINUE
      JST=JS
      XR(1)=X1
      YR(1)=Y1
      ISB=1
      JSB=1
      DO 70N=2,N50
      IF (ISB.LE.IST)GO TO 46
      IF (JSB.GT.JST) GO TO 72
      GO TO 52
   46 ISX=ISB
      DO 47 IS=ISX,IST
      IF (XI(IS).GT.XR(N-1))GO TO 48
   47 ISB=ISB+1
      IF (JSB.GT.JST) GO TO 72
      GO TO 52
   48 IF (JSB.GT.JST)GO TO 64
   52 JSX=JSB
      DO 54 JS=JSX,JST
      IF (XJ(JS).GT.XR(N-1))GO TO 56
   54 JSB=JSB+1
      IF (ISB.GT.IST) GO TO 72
      GO TO 64
   56 IF (ISB.GT.IST)GO TO 60
   58 IF (XI(IS)-XJ(JS))64,62,60
   60 XR(N)=XJ(JS)
      YR(N)=YJ(JS)
      JSB=JSB+1
      GO TO 70
   62 JSB=JSB+1
   64 XR(N)=XI(IS)
      YR(N)=YI(IS)
      ISB=ISB+1
   70 CONTINUE
   72 N=N-1
      IF (X2.LE.XR(N))GO TO 75
      N=N+1
      XR(N)=X2
      YR(N)=Y2
   75 NSO=N-1
```

```
      IX(N)=(XR(N)+XR(N+1))*0.5
      JY(N)=(YR(N)+YR(N+1))*0.5
      DDL=XR(N+1)-XR(N)
      IF (DX.LT.0.1 .AND. DX.LT.ABS(DY))DDL=ABS(YR(N+1)-YR(N))
   80 FF(N)=DLI*DDL
  100 RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE ARELND(VOL,AREA,LANDUS)
      DIMENSION VOL(2)
      INTEGER AREA
      COMMON/QUSTN1/YES,QPIN,QPGD1,QPGD2,QPGDT,QPFILE,QPOL(3),QAPRAC,QSE
     1C,QCAPR,QHRVOL,QFHWA,QSPD,ALT,CALIF,AREAID,QSTRT,QISMAP,QMIX
     2,NWIND,LCODE
C
C     THIS SUBROUTINE PROVIDES A DEFAULT CATEGORY FOR LAND USE IF IT IS
C     NOT AVAILABLE.  AREA TYPES 1 AND 2 (CBD AND CORE CITY) ARE ASSUMED
C     COMMERCIAL LAND USE (LANDUS=1).  AREA TYPE 3 (SUBURBAN) IS
C     CONSIDERED COMMERCIAL IF ADT IS GREATER THAN 10000.  OTHER VALUES
C     CAN BE USED IF MORE SUITABLE FOR YOUR AREA.  SMALLER SUBURBAN ADT
C     IS ASSUMED RESIDENTIAL (LANDUS=2).  ANY OTHER AREA TYPES ARE
C     ASSIGNED TO THE MISCELLANEOUS LAND USE CATEGORY (LANDUS=6).
C
      DATA CONVOL/10000./
      LANDUS =1
      IF(AREA .LE.2) GO TO 86
      IF (AREA.EQ.3) GO TO 50
      LANDUS=6
      GO TO 86
   50 AWDT = VOL(1) + VOL(2)
      IF (QHRVOL .EQ. YES) AWDT=9.0 *AWDT
C     DAILY TRAFFIC ASSUMED TO BE 9X HOURLY
      LANDUS =2
      IF (AWDT .GE. CONVOL) LANDUS = 1
   86 CONTINUE
      RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE SECOND(TRAF2,NGRIDE,NGRIDN,     LWFAC,GSIZE,TFILE1,NTLN
     1K)
C
C     THIS SUBROUTINE ESTIMATES SECONDARY TRAFFIC ON THE BASIS OF
C     PRIMARY TRAFFIC AND THE NATURE OF THE LINKS AND THEIR SURROUNDINGS
C     (LOCL).  THE SECONDARY TRAFFIC IS GRIDDED. --BOBICK
C
      DIMENSION TRAF2(25,25),LWFAC(5),IX(50),IY(50),FF(50)
      COMMON/QUSTN1/YES,QPIN,QPGD1,QPGD2,QPGDT,QPFILE,QPOL(3),QAPRAC,QSE
     1C,QCAPR,QHRVOL,QFHWA,QSPD,ALT,CALIF,AREAID,QSTRT,QISMAP,QMIX
     2,NWIND,LCODE
      INTEGER TFILE1,AREA
      REAL LENGTH
      REAL LWFAC
      REWIND TFILE1
      DO 50 I=1,25
      DO 50 J=1,25
      TRAF2(I,J)=0.0
   50 CONTINUE
      TAJVMT = 0.0
      DO 125 M=1,NTLNK
      READ(TFILE1,6001,END=10000)LINK1,LINK2,X1,Y1,X2,Y2,LENGTH,LANDUS,A
     1REA,IFAC,VOL1,VOL2,CAP,LOCL,L,LAR,LFC
C
C      FOR NON-FHWA TRAFFIC SPEED IS STORED WHERE DIRECT VOL IS FOR FHWA
C
10000 IF (QFHWA .NE. YES) VOL2=VOL1
C
C     GETTING TOTAL ADJUSTED VMT(TAVMT1)--PROPORTIONAL TO TRAFFIC AND
C     LOCALE WEIGHTING FACTOR(LWFAC)
C
      TAVMT1 = (VOL1+VOL2)*LENGTH*LWFAC(LOCL)
      TAJVMT = TAJVMT + TAVMT1
C
C     GRIDDING ADJUSTED SECONDARY TRAFFIC
C
      CALL GRID(X1,Y1,X2,Y2,GSIZE,MM,IX,IY,FF)
      DO 125 K=1,MM
      I=IX(K)
      J=IY(K)
      IF (I .GT. NGRIDE .OR. J .GT. NGRIDN) GO TO 125
      IF(I.LT.1.OR.J.LT.1) GO TO 125
      TRAF2(I,J)=TRAF2(I,J)+FF(K)*TAVMT1
  125 CONTINUE
  186 IF (TAJVMT .LE. 0.0) GO TO 86
      RT=1.0/TAJVMT
      DO 190 I=1,NGRIDE
      DO 190 J=1,NGRIDN
      TRAF2(I,J)=TRAF2(I,J)*RT
  190 CONTINUE
  86 PRINT 6002
     STOP
 200 CONTINUE
     REWIND TFILE1
6001 FORMAT(BZ,2I5,4F8.4,F5.2,3I1,3F8.0,1X,4I1)
6002 FORMAT (60H1 TOTAL ADJUSTED TRAFFIC=0, RUN STOPPED IN SUBROUTINE S
    1ECOND    )
     RETURN
     END
```

```
      SUBROUTINE PRINCE(NGRIDE,NGRIDN,GSIZE,IDAY,IHR,ISEA,IYR,TEMP)
C
C     PRINTS GRIDDED EMISSIONS -- LUDWIG
C
      COMMON/QUSTN1/YES,QPIN,QPGD1,QPGD2,QPGDT,QPFILE,QPOL(3),QAPRAC,QSE
     1C,QCAPR,QHRVOL,QFHWA,QSPD,ALT,CALIF,AREAID,QSTRT,QISMAP,QMIX
     2,NWIND,LCODE
      COMMON/INOUTS/NCARD1,NCARD,NCARD2,NCARDR,NOUT,TFILE0,TFILE1,TFILE2
     1,NCARDX,NCARDW,INPT,IDISK
      COMMON/GRDEMS/EMISSN(3,25,25),SECEMS(3,25,25)
      DIMENSION STUFF(3),MUCH(3),TOTEM(25),PLACE(4)
      DATA STUFF/3HHC ,3HCO ,3HNOX/
      DATA MUCH/3HPRI,3HSEC,3HTOT/
      DATA PLACE/3HNON,3HCAL,3HCAL,3HIF./
      LAST=NGRIDE
      IF(NGRIDE.GT.15) LAST=15
      IP = 1
      IF (CALIF. EQ. YES) IP=3
      IPP1 = IP + 1
      DO 100 L=1,3
      IF(QPOL(L).NE.YES) GO TO 100
      IF(QPGD1.NE.YES) GO TO 25
      WRITE(NOUT,6001)GSIZE,MUCH(1),STUFF(L),AREAID,ALT,PLACE(IP),PLACE(
     1IPP1),IYR  ,ISEA,IDAY,IHR , TEMP
      N1=1
      N2=LAST
    5 WRITE(NOUT,6002)
      WRITE(NOUT,6003)(IG,IG=N1,N2)
      DO 10 IN=1,NGRIDN
      NINV=NGRIDN-IN+1
      WRITE(NOUT,6004)NINV,(EMISSN(L,JJ,NINV),JJ=N1,N2)
   10 CONTINUE
      IF(NGRIDE.LE.15) GO TO 25
      IF(N1.GT.1) GO TO 25
      N1=16
      N2=NGRIDE
      GO TO 5
   25 IF(QPGD2.NE.YES) GO TO 50
      WRITE(NOUT,6001)GSIZE,MUCH(2),STUFF(L),AREAID,ALT,PLACE(IP),PLACE(
     1IPP1),IYR  ,ISEA,IDAY,IHR , TEMP
      N1=1
      N2=NGRIDE
      IF (N2 .GT. 15) N2=15
   35 WRITE(NOUT,6002)
      WRITE(NOUT,6003)(IG,IG=N1,N2)
      DO 40 IN=1,NGRIDN
      NINV=NGRIDN-IN+1
      WRITE(NOUT,6004)NINV,(SECEMS(L,JJ,NINV),JJ=N1,N2)
   40 CONTINUE
      IF(NGRIDE.LE.15) GO TO 50
      N1=16
      N2=NGRIDE
      GO TO 35
   50 IF(QPGDT.NE.YES) GO TO 100
      WRITE(NOUT,6001)GSIZE,MUCH(3),STUFF(L),AREAID,ALT,PLACE(IP),PLACE(
     1IPP1),IYR  ,ISEA,IDAY,IHR , TEMP
      N1=1
      N2=NGRIDE
      IF(N2.GT.15) N2=15
   55 WRITE(NOUT,6002)
      WRITE(NOUT,6003)(IG,IG=N1,N2)
      DO 70 IN=1,NGRIDN
      NINV=NGRIDN-IN+1
      DO 67 IE=N1,N2
      TOTEM(IE)=SECEMS(L,IE,NINV)+EMISSN(L,IE,NINV)
   67 CONTINUE
      WRITE(NOUT,6004)NINV,(TOTEM(JJ),JJ=N1,N2)
   70 CONTINUE
      IF(NGRIDE.LE.15) GO TO 100
      IF(N1.GT.1) GO TO 100
      N1=16
      N2=NGRIDE
      GO TO 55
  100 CONTINUE
 6001 FORMAT(BZ,1H1,F5.2,11HKM GRID OF ,A4,1H ,A3,29H EMISSIONS IN G/HR
     1FOR AREA= ,A5,5H ALT=,A2,1H ,2A3,1X,6H YEAR=,I4,8H SEASON=,I1,5H D
     2AY= ,I1, 6H HOUR= ,I2,8H00 TEMP=,F3.0,1HF )
 6002 FORMAT(1H0,22HNORTH    GRIDS EAST-- )
 6003 FORMAT(1H ,6HGRIDS ,15(6X,I2))
 6004 FORMAT(3X,I2,5X,15E8.2)
      RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE CALALT(ALT,CALIF,LCODE)
C
C     THIS SUBROUTINE DETERMINES THE CODE USED FOR CALCULATING EMISSIONS
C     IN THE INTERSECTION MODEL
C
C     LCODE=1 -- NON-CALIFORNIA, LOW ALTITUDE METHODOLOGY
C     LCODE=2 -- CALIFORNIA, LOW ALTITUDE
C     LCODE=3 -- HIGH ALTITUDE
C
      DATA HI /3HHI /
      DATA YES /3HYES/
      IF(ALT.EQ.HI) GO TO 50
      LCODE=1
      IF(CALIF.EQ.YES) LCODE=2
      GO TO 60
   50 LCODE=3
   60 CONTINUE
      RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE PICKIT(LOCL,ISP,XT1,XT2,YT1,YT2,EMMY,
     1INTSPD,INTLOC,LCHECK,ORIGE,ORIGN,GVERT)
      DIMENSION SX1(8),SX2(8),SY1(8),SY2(8),INTSPD(8),INTLOC(8)
      COMMON/DIMINT/ZCONST,HEIGHT(8),NLANE(8),XII1(4),YII1(4),XII2(4),YI
     1I2(4)
C
C     THIS SUBROUTINE IDENTIFIES THOSE LINKS IN THE TRAFFIC FILE THAT
C     ARE TO BE USED FOR INTERSECTION MODELING.  EMISSIONS ARE ADJUSTED
C     TO ALLOW FOR SUBSEQUENT DETAILED CALCULATIONS WITH INTERSECTION/
C     LINE-SOURCE MODEL. --LUDWIG
C
      IF(LCHECK.GT.0) GO TO 30
C
C     SETTING DEFAULT SPEED(INTSPD) AND LOCALE (INTLOC) VALUES--19.5MPH
C     AND COMMERCIAL.         INTERSECTION LINK COORDINATES ARE CONVER-
C     TED TO KILOMERS. DONE ONCE ONLY.
C
      DO 25 I=1,4
      IP4=I+4
      INTSPD(I)=7
      INTSPD(IP4) = INTSPD(I)
      INTLOC(I)=5
      INTLOC(IP4) = INTLOC(I)
      SX1(I) = (XII1(I) - ORIGE) * GVERT
      SX2(I) = (XII2(I) - ORIGE) * GVERT
      SY1(I) = (YII1(I) - ORIGN) * GVERT
      SY2(I) = (YII2(I) - ORIGN) * GVERT
   25 CONTINUE
      LCHECK=1
   30 DO 50 I=1,4
      IP4=I+4
C
C     DUMMY LINKS HAVE CONGRUENT END POINTS.
C
      RL2=(SX1(I)-SX2(I))*(SX1(I)-SX2(I))+(SY1(I)-SY2(I))*(SY1(I)-SY2(I)
     1)
      IF(RL2.LT.1.0E-6) GO TO 50
      DX1=(SX1(I)-XT1)
      DX2=(SX2(I)-XT2)
      DY1=(SY1(I)-YT1)
      DY2=(SY2(I)-YT2)
      CLOSE=DX1*DX1+DY1*DY1+DX2*DX2+DY2*DY2
C
C        IF END POINTS AVERAGE WITHIN ABOUT 15-M THEN LINKS ARE
C     ASSUMED TO BE THE SAME.
C
      IF(CLOSE.GT.4.0E-4) GO TO 47
   35 INTSPD(I)=ISP
      INTSPD(IP4) = INTSPD(I)
      INTLOC(I)=MOD(LOCL,5)
      IF (INTLOC(I) .GT. 3) INTLOC(I) = 3
      INTLOC(I) = LOCL/6 + INTLOC(I)
      INTLOC(IP4) = INTLOC(I)
C
C        WHEN INTERSECT MODEL USED, INTERSECT LINKS ASSIGNED ZERO
C        EMISSIONS IN LINK FILE
C
      EMMY=0.0
      GO TO 50
C        REVERSE ENDS
   47 DX1=(SX2(I)-XT1)
      DX2=(SX1(I)-XT2)
      DY1=(SY2(I)-YT1)
      DY2=(SY1(I)-YT2)
      CLOSE=DX1*DX1+DY1*DY1+DX2*DX2+DY2*DY2
      IF(CLOSE.GT.4.0E-4) GO TO 50
      GO TO 35
   50 CONTINUE
      RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE ZAVE(A1,B1,A2,B2,EM,LEN,LUS,AR,IFC,V1,V2,CP,LC,I,NC)
C    * QFHWA,YES)
C
C     THIS SUBROUTINE STORES NC TRAFFIC LINKS
C     IN COMMONS CLDAT AND CDAT2--JONES
C
      REAL LENGTH,LEN
      INTEGER AR,AREA
      COMMON /CLDAT/X1(1200),Y1(1200),X2(1200),Y2(1200),E(1200),NEARNO
C
C     THE FOLLOWING VERSION USES MORE CORE--SEE GETZ
C
C     COMMON /CDAT2/LENGTH(1200),LANDUS(1200),AREA(1200),IFAC(1200),
C    1VOL1(1200),VOL2(1200),CAP(1200),LOCL(1200)
C     NEARNO = NC
C     X1(I)=A1
C     X2(I)=A2
C     Y1(I)=B1
C     Y2(I)=B2
C     E(I)=EM
C     LENGTH(I)=LEN
C     LANDUS(I)=LUS
C     AREA(I)=AR
C     IFAC(I)=IFC
C     VOL1(I)=V1
C     VOL2(I)=V2
C     CAP(I)=CP
C     LOCL(I)=LC
C
C     VERSION TO BE USED TO CONSERVE CORE--SEE GETZ.
C
      COMMON /CDAT2/ IV1LU(1200),IV2AR(1200),ICAPF(1200),ILCL(1200)
     1,RLENG(1200)
      NEARNO = NC
      X1(I)=A1
      X2(I)=A2
      Y1(I)=B1
      Y2(I)=B2
      E(I)=EM
      IV=(V1+50.)/100.
      IV1LU(I)=(10*IV)+LUS
      IV=(V2+50.)/100.
      IF(QFHWA.NE.YES) IV=V2
      IV2AR(I)=(10*IV)+AR
      IV=(CP+50.0)/100.
      ICAPF(I)=(10*IV)+IFC
      ILCL(I)=LC
      RLENG(I) = LEN
      RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
```

```
      SUBROUTINE GETZ(J,A1,B1,A2,B2,LEN,LUS,AR,IFC,V1,V2,CP,LC)
C    * QFHWA,YES)
C
C     THIS SUBROUTINE RETRIEVES STORED TRAFFIC LINK DATA
C     FROM COMMONS CLDAT AND CDAT2--JONES
      INTEGER AR,AREA
      REAL LEN,LENGTH
      COMMON /CLDAT/X1(1200),Y1(1200),X2(1200),Y2(1200),F(1200),NEARNO
C
C     THE FOLLOWING VERSION USES MORE CORE--SEE ZAVE
C
C     COMMON /CDAT2/LENGTH(1200),LANDUS(1200),AREA(1200),IFAC(1200),
C    1VOL1(1200),VOL2(1200),CAP(1200),LOCL(1200)
C     A1 = X1(J)
C     A2 = X2(J)
C     B1 = Y1(J)
C     B2 = Y2(J)
C     LEN = LENGTH(J)
C     LUS = LANDUS(J)
C     AR = AREA(J)
C     IFC = IFAC(J)
C     V1 = VOL1(J)
C     V2 = VOL2(J)
C     CP = CAP(J)
C     LC = LOCL(J)
C
C     VERSION TO BE USED TO CONSERVE CORE--SEE ZAVE
C
      COMMON /CDAT2/ IV1LU(1200),IV2AR(1200),ICAPF(1200),ILCL(1200)
     1,RLENG(1200)
      A1 = X1(J)
      A2 = X2(J)
      B1 = Y1(J)
      B2 = Y2(J)
      LUS = MOD(IV1LU(J),10)
      IV = IV1LU(J)/10
      V1 = IV*100
      AR = MOD(IV2AR(J),10)
      IV = IV2AR(J)/10
      V2 = IV*100
      IF(QFHWA.NE.YES) V2=IV
      IFC = MOD(ICAPF(J),10)
      IV = ICAPF(J)/10
      CP = IV*100
      LC = ILCL(J)
      LEN = RLENG(J)
      RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE EMOD
C
C     THIS SUBROUTINE DETERMINES EMISSIONS ON LINKS AND SUMS THEM
C     OVER GRID SQUARES.--ALSO CREATES AN EMISSIONS FILE(TFILE3) IF
C     DIFFUSION CALCULATIONS ARE REQUIRED--1 RECORD/SQ,UP TO 306 LINKS/
C     RECORD.  EACH LINK CHARACHTERIZED BY 4 COORDINATES AND EMISSIONS
C     FOR POLLUTANT OF INTEREST.--BOBICK AND LUDWIG
C
      INTEGER TFILE1,TFILE2,     TFILE3,SQRL,AREA,AR,FC,TFILE0
      REAL LENGTH
      DIMENSION LOCSQ(25,25),IX(50),IY(50),FF(50),VOL(2),TEMPD(1530),
     1 EM(3),S(2),IS(2), VMT(2)
      COMMON/TFCSTF/ADJSPD(2,5,24),DEFCAP(2),DTRAF(2,12,24),DTRAF2(3,24)
     1,TRAF2(25,25),SPD(2,5),SEASON(4), EMIS(3,6,20), AVGSP2, TVMT2
      COMMON/ODDEND/NTLNK,IYEAR, IHOUR, IDAY,ISEA
      COMMON/GG/NGRIDE,NGRIDN,GSIZE,ORIGE,ORIGN,GVERT
      COMMON /DAYLYT/ LOCDHR,LOCTYM
      COMMON/GRDEMS/EMISSN(3,25,25),SECEMS(3,25,25)
      COMMON/LINDEX/NUMLNK(25,25),LOCAD(25,25),LSQIDX(625)
      COMMON/COMING/TF(20),CORFAC(20,20,2),EMIDLE(2)
      COMMON/INOUTS/NCARD1,NCARD,NCARD2,NCARDR,NOUT,TFILE0,TFILE1,TFILE2
     1,NCARDX,NCARDW,INPT,IDISK
      COMMON/SFC/IWD(24),WS(24),ICLD(24),ITEMP(24)
      COMMON/CLINE/IJLOC(8),IJSPD(8)
      COMMON/QUSTN1/YES,QPIN,QPGD1,QPGD2,QPGDT,QPFILE,QPOL(3),QAPRAC,QSE
     1C,QCAPR,QHRVOL,QFHWA,QSPD,ALT,CALIF,AREAID,QSTRT,QISMAP,QMIX
     2,NWIND,LCODE
      COMMON /QUSTN2/QBIG,VMTMIN,QRFILE,NCUT,MDIM
      EQUIVALENCE (LOCSQ(1,1),LOCAD(1,1))
      DATA NCALLZ,NO /0,3HNO /
      REWIND TFILE1
C        IHOUR=STANDARD TIME
C        LOCTYM,IHR=TIME IN USE
      IF (QAPRAC .NE. YES) LOCTYM = IHOUR
      IHR = LOCTYM
      IF (NCALLZ .GT.0) GO TO 2001
      DO 10 KPOL = 1,3
      IF (QPOL(KPOL) .EQ. YES) GO TO 11
   10 CONTINUE
C
C     DEFINING RANDOM FILE INFORMATION
C
   11 LSQIDL=626
      SQRL=1530
      LCHECK=0
      TFILE3 = 13
      IF(QBIG.EQ.YES) GO TO 1999
C******************  IBM  *********************
C     DEFINE FILE 13 (625,1530,U,IVBL)
      OPEN(UNIT=13,ACCESS='DIRECT',BLOCKSIZE=625,RECL=1530,
C*******************IBM**************
C
C*******************  CDC  ************************
C     CALL OPENMS (TFILE3, LSQIDX, LSQIDL, 0)
C********************************
 1999 CONTINUE
      NCALLZ = 1
 2001 CONTINUE
      TEMP=ITEMP(IHOUR)
C
C      WHEN APRAC IS USED TEMPS ARE STORED IN DEGREES KELVIN
C
      IF (QAPRAC.EQ. YES) TEMP = (TEMP-273.)*1.8 + 32.
C
C     SETTING ALL GRID EMISSIONS TO ZERO
C
      DO 20 I=1,25
      DO 20 J=1,25
      LOCAD(I,J) =-9
      DO 20 IPOL=1,3
      EMISSN(IPOL,I,J)=0.0
      SECEMS(IPOL,I,J)=0.0
   20 CONTINUE
      IXX=0
C
C     SETTING UP TEMPORARY STORAGE FOR NEW LINK EMISSION FILES.
C
      DO 66 NTEMP=1,1530
      TEMPD(NTEMP)=-999.0
   66 CONTINUE
C
C     CALCULATING EMISSION FACTORS (EMIS--GM/VEH-MI)
C
C
      DO 70 INDXPL=1,3
      IF(QPOL(INDXPL).NE.YES) GO TO 70
      DO 77 INDXSP=1,20
      READ(IDISK,71,END= 77  ) (EMIS(INDXPL,LOCFAC,INDXSP),LOCFAC=1,6)
 77   CONTINUE
 70   CONTINUE
      IF(QISMAP.NE.YES) GO TO 51
      READ(IDISK,72,END=10000) (TF(IMJ),IMJ=1,20)
10000 DO 73 INDXPL=1,2
      IF(QPOL(INDXPL).NE.YES) GO TO 73
      DO 78 INDXSP=1,20
      READ(IDISK,74,END= 78  ) (CORFAC(IMY,INDXSP,INDXPL),IMY=1,20)
 78   CONTINUE
 73   CONTINUE
      DO 75 INDXPL=1,2
      IF(QPOL(INDXPL).NE.YES) GO TO 75
 75   CONTINUE
 51   MFILE = TFILE1
      INDEX=0
   50 INDEX=INDEX+1
      IF(QBIG.EQ.YES) GO TO 55
      READ ( MFILE,6001,END=10001)ID1,ID2,X1,Y1,X2,Y2,LENGTH,LANDUS,AREA
     2,IFAC,VOL(1),VOL(2),CAP,      LOCL, LU,AR,FC
10001 GO TO 56
   55 CALL GETZ(INDEX,X1,Y1,X2,Y2,LENGTH,LANDUS,AREA,IFAC,VOL(1),
     1VOL(2),CAP,LOCL)
   56 CONTINUE
      IF(QFHWA .NE. YES) SPEED=VOL(2)
      IF(QFHWA .NE. YES) VOL(2)=VOL(1)
      DO 80 I=1,3
      EM(I)=0.0
   80 CONTINUE
      DO 160 I=1,2
      IF(QCAPR .EQ.YES) GO TO 120
      IF(QSPD.EQ.YES) GO TO 110
C
C     GETTING SPEED(S) AND SPEED CLASS(IS) FOR BOTH DIRECTIONS(I)
C     FROM DAILY SPEED PROFILES.
C
      S(I)=SPD(IFAC,LOCL)*ADJSPD(1,LOCL,IHR)
      GO TO 130
  110 S(I)=SPEED
      GO TO 130
C
C     GETTING SPEED(S) AND SPEED CATEGORY(IS) FROM CAPACITY RESTRAINT.
C
  120 XONE=0.
      IF(VOL(1).LT.1..OR.VOL(2).LT.1.) XONE=1.
      C=CAP
      IF(CAP.LT.1.)C=DEFCAP(IFAC)/(XONE+1.)
      IF(XONE.EQ.0.)C=0.5*C
      K=(IFAC-1)*5+LOCL
      IF(IDAY.EQ.1)K=12
      IF(IDAY.EQ.7)K=11
      A=DTRAF(I,K,IHR)*SEASON(ISEA)
      IF(QHRVOL.EQ.YES)A=1.0
      VV = VOL(I)*A/C
      S(I)=SPD(IFAC,LOCL)/(1.0+0.15*(VV*VV*VV*VV))
  130 IS(I)=0.3333*S(I)+1.0
      XLONG=LENGTH
      K=(IFAC-1)*5+LOCL
      IF(IDAY.EQ.1)K=12
      IF(IDAY.EQ.7)K=11
      A=DTRAF(I,K,IHR)*SEASON(ISEA)
      IF(QHRVOL.EQ.YES)A=1.0
      VMT(I)=VOL(I)*XLONG
      IF(QPOL(L).NE.YES) GO TO 150
      JS = MINO(20,IS(I))
      IF(JS.LE.1)   JS=2
      LL = MINO(3,LOCL)
      K=(IFAC-1)*3+LL
      EM(L)=EM(L)+VMT(I)*EMIS(L,K,JS)*A
  150 CONTINUE
  160 CONTINUE
      IF(QAPRAC.EQ.NO) GO TO 165
      IF(QISMAP.NE.YES) GO TO 165
      DO 161 NPOL=1,2
      IF(QPOL(NPOL).EQ.YES) GO TO 162
  161 CONTINUE
      GO TO 165
C
C     CHECK TO SEE IF LINK IS INVOLVED IN LINE SOURCE CALCULATIONS.
C     MAKE APPROPRIATE ADJUSTMENTS IN EMISSIONS FILE.  NOX EMISSIONS NOT
C     CHANGED.
C
  162 JS=(IS(1)+IS(2))/2
      CALL PICKIT(LOCL,JS,X1,X2,Y1,Y2,EM(NPOL),IJSPD,
     1IJLOC,LCHECK,ORIGE,ORIGN,GVERT)
C
C     GRIDDING PRIMARY EMISSIONS
C
  165 CALL GRID(X1,Y1,X2,Y2,GSIZE,NN,IX,IY,FF)
      IF (NN.LE.0) GO TO 195
      DO 180 K=1,NN
      I=IX(K)
      J=IY(K)
      IF(I.GT.NGRIDE) GO TO 180
      IF(J.GT.NGRIDN) GO TO 180
      IF(I.LT.1.OR.J.LT.1) GO TO 180
      F=FF(K)
      DO 170 L=1,3
      IF(QPOL(L).NE.YES) GO TO 170
      EMISSN(L,I,J)=EMISSN(L,I,J)+EM(L)*F
  170 CONTINUE
  180 CONTINUE
      IF(QBIG.EQ.YES) CALL ZAVE(X1,Y1,X2,Y2,EM(KPOL),LENGTH,LANDUS,
     1AREA,IFAC,VOL(1),VOL(2),CAP,LOCL,INDEX,NCUT)
  195 IF(QPFILE.NE.YES) GO TO 190
      IF(MOD(INDEX,50).EQ.1)WRITE(NOUT,6003)AREAID,ALT,IYEAR,ISEA,IHOUR,
     1IDAY,TEMP
      WRITE(NOUT,6002)ID1,ID2,X1,Y1,X2,Y2,LENGTH,LANDUS,AREA,IFAC,VOL(1)
     1,VOL(2),CAP,LU, AR,FC,LOCL,S(1),S(2),EM(1),EM(2),EM(3)
  190 IF(QAPRAC.EQ.YES) GO TO 200
      IF (INDEX .LT. NTLNK ) GO TO 50
      GO TO 300
  200 IF(QBIG.EQ.YES) GO TO 250
```

```
      MXXP=0.5*(X1+X2)/GSIZE + 1.
      MYYP=0.5*(Y1+Y2)/GSIZE + 1.0
      LSQ=1
C
C     CHECK TO SEE IF WE ARE TO A NEW SECTION OF THE FILE
C
  210 IF(QBIG.EQ.YES) GO TO 50
      MXX=0.5*(X1+X2)/GSIZE + 1.0
      MYY=0.5*(Y1+Y2)/GSIZE + 1.0
      IF(MXX.NE.MXXP) GO TO 225
      IF(MYY.NE.MYYP) GO TO 225
C
C     ASSIGNING LINK DATA TO RECORD--ONE RECORD/SQUARE.
C
      IXP1=IXX+1
      IXP2=IXX+2
      IXP3=IXX+3
      IXP4=IXX+4
      IXP5=IXX+5
      IF(IXP5.GT.1530) GO TO 686
      TEMPD(IXP1)=X1
      TEMPD(IXP2)=Y1
      TEMPD(IXP3)=X2
      TEMPD(IXP4)=Y2
      TEMPD(IXP5)=EM(KPOL)
      IXX=IXP5
      MXXP=MXX
      MYYP=MYY
      IF (INDEX .LT. NTLNK ) GO TO 50
  225 LOCSQ(MXXP,MYYP)=LSQ
C
C     WRITING RECORD FOR THIS SQUARE AND STARTING NEXT SQUARE
C
C**************IBM*****************
      WRITE (13' LSQ) (TEMPD(LLF), LLF=1,1530)
C*******************************
C
C****************  CDC  **********************
C     CALL WRITMS(TFILE3,TEMPD,SQRL,LSQ)
C*********************************************
      LSQ=LSQ+1
      IXX=0
      MXXP=MXX
      MYYP=MYY
C
C     NEGATIVE 999 FILL TO IDENTIFY UNUSED CELLS.
C
      DO 228 NTEMP=1,1530
      TEMPD(NTEMP)=-999.0
  228 CONTINUE
```

```
      IF (INDEX .LT. NTLNK) GO TO 210
C
C     ACCUMULATING EMISSIONS FROM SECONDARY TRAFFIC
C
  300 K=1
      IF(IDAY.EQ.7)K=2
      IF(IDAY.EQ.1)K=3
      JS=AVGSP2/3.0 + 1.0
      IF(JS.GT.20)JS=20
      IF(JS.LT.2)JS=2
      A=DTRAF2(K,IHR)*SEASON(ISEA)
      IF(QHRVOL.EQ.YES)A=1.0
      DO 350 L=1,3
      IF(QPOL(L).NE.YES) GO TO 350
      DO 325 I=1,NGRIDE
      DO 325 J=1,NGRIDN
      SECEMS(L,I,J)=TRAF2(I,J)*EMIS(L,6,JS)*A*TVMT2
  325 CONTINUE
  350 CONTINUE
      CALL PRINCE(NGRIDE,NGRIDN,GSIZE,IDAY,IHOUR,ISEA,IYEAR,TEMP)
      GO TO 711
  686 PRINT 6004
      STOP
  711 REWIND TFILE1
 71   FORMAT(BZ,6F10.4)
 72   FORMAT(BZ,20F5.3)
 74   FORMAT(BZ,20F5.2)
 76   FORMAT(BZ,F10.4)
6001 FORMAT(BZ,2I5,4F8.4,F5.2,3I1,3F8.0,1X,4I1)
6002 FORMAT(1X,I4,I5,4F8.2,F7.2,I4,I6,I4,2F8.0,F7.0,I3,2I1,I4,2F4.0,
    1 3(1X, E8.2))
6003 FORMAT(1H1,51HTRAFFIC LINK FILE AND EMISSIONS (G/LINK/HR)--AREA= ,
    1A5,6H ALT= ,A2,7H YEAR= ,I4,9H SEASON=  ,I1,7H HOUR=  ,I2,9H DAY N
    1O.  ,I2,7H TEMP=  ,F4.0,
    2        1HF/130H ID-A  ID-B    XA       YA       XB       YB   LENGTH
    3 USE AREA FAC. VOLAB   VOLBA   CAP   LAF LOCL SPD,AB/BA    HC
    3 CO      NO        )
6004 FORMAT(1H1,68HTOO MANY LINKS IN ONE SQUARE--CHECK DIMENSIONS IN EM
    1OD RUN STOPPED  )
     RETURN
     END
```

```
      SUBROUTINE REFILE
C
C
C**********************************
C
C  CONSTRUCT A RANDOM ACCESS FILE OF TRAFFIC LINKS ORGANIZED BY
C         GEOGRAPHICAL LOCATION.  ALL LINKS WHOSE MIDPOINTS FALL IN
C         A GIVEN 3 KM BY 3 KM SQUARE ARE TOGETHER.  WE KEEP A LIST
C         OF THE RECORD NUMBER OF THE FIRST RECORD FOR EACH SQUARE
C         AND THE NUMBER OF LINKS (RECORDS) WITHIN THE SQUARE
C        ---LUDWIG/WHEELER
      INTEGER NUMLNK, I, J,NPASS, N, IIX, IIY, NNN, LOCAD
      INTEGER TFILE1, TFILE2
      REAL    XA, XB, YA, YB, AVX, AVY
      REAL SFA
      INTEGER MSINDX,MSINDL,FRL
      DIMENSION MSINDX(8000), SFA(17)
      COMMON/LINDEX/NUMLNK(25,25),LOCAD(25,25),LSQIDX(625)
      COMMON/INOUTS/NCARD1,NCARD,NCARD2,NCARDR,NOUT,TFILE0,TFILE1,TFILE2
     1,NCARDX,NCARDW,INPT,IDISK
      COMMON/ODDEND/NTLNK,IYEAR, IHOUR, IDAY,ISEA
      MSINDL=8001
      FRL = 17
C******************  IBM  **********************
C     DEFINE FILE 12 (8000,17,U,IVAR)
      OPEN(UNIT=12,ACCESS='DIRECT',BLOCKSIZE=8000,RECL=17,
     *STATUS='SCRATCH')
C***********************************************
C
C******************  CDC  ***********************
C     CALL OPENMS(TFILE2,MSINDX,MSINDL,0)
C***********************************************
      REWIND TFILE1
      DO  100  J = 1, 25
      DO  100  I = 1, 25
  100 NUMLNK(I,J) = 0
      NPASS = 0
      N=0
      M=0
C  READ TRAFFIC RECORD
C  CHECK END-OF-FILE
  200 IF(N.GE.NTLNK) GO TO 300
      READ(TFILE1,900,END=10000) I1,I2,XA,YA,XB,YB
10000 N=N+1
C  CREATE COUNTS FOR EACH SQUARE
 900  FORMAT(BZ,2I5,4F8.4)
C  CALCULATE MIDPOINT
      AVX = 0.5 * (XA + XB)
      AVY = 0.5 * (YA + YB)
C  CALCULATE SQUARE NUMBER
```

```
      IIY = 1.0 + (AVY/3.0)
C   CHECK FOR OUT OF BOUNDS
      IF (IIX .GT. 25) GO TO 200
      IF (IIX .LE. 0) GO TO 200
      IF (IIY .GT. 25) GO TO 200
      IF (IIY .LE. 0) GO TO 200
C     COUNTING RETAINED LINKS WITHIN 25 X 25 GRID
      M=M+1
C   INCREMENT NUMBER OF LINKS IN THIS SQUARE
      NUMLNK (IIX, IIY) = NUMLNK (IIX, IIY) + 1
      GO TO 200
  300 CONTINUE
      N=0
      REWIND TFILE1
C   CREATE STARTING ADDRESS FOR SUBFILE FOR EACH SQUARE
  320 NNN = 1
      DO 400 IIY = 1, 25
      DO 350 IIX = 1, 25
      LOCAD (IIX, IIY) = NNN
      NNN = NNN + NUMLNK (IIX, IIY)
  350 CONTINUE
  400 CONTINUE
C   CHECK FOR DONE
      IF (NPASS .GE. 1) GO TO 600
      NPASS = 1
C   GENERATE SORTED FILE
C   READ RECORD
C
  500 IF(N.GE. NTLNK) GO TO 320
      READ(TFILE1,6010,END=10001) ID1,ID2,(SFA(M1),M1=3,7),LAND,IAREA,IF
     1AC,(SFA(M2),M2=11,13),LOCL,LU,LAR,LFC
10001 N=N+1
C   CHECK END-OF-FILE
C   CALCULATE LINK MIDPOINTS
      XA = SFA(3)
      YA = SFA(4)
      XB = SFA(5)
      YB = SFA(6)
      AVX = 0.5 * (XA + XB)
      AVY = 0.5 * (YA + YB)
C   CALCULATE SQUARE INDICES
      IIX = 1.0 + (AVX/3.0)
      IIY = 1.0 + (AVY/3.0)
C   CHECK FOR OUT OF BOUNDS
      IF (IIX .GT. 25) GO TO 500
      IF (IIX .LE. 0) GO TO 500
      IF (IIY .GT. 25) GO TO 500
      IF (IIY .LE. 0) GO TO 500
C   GET RELATIVE LOCATION
      INDEX = LOCAD (IIX, IIY)
      SFA(2)=ID2
      SFA(8)=LAND
      SFA(9)=IAREA
      SFA(10)=IFAC
      SFA(14)=LOCL
      SFA(15)=LU
      SFA(16)=LAR
      SFA(17)=LFC
C
C          CURRENT DIMENSION PROVIDE FOR 8000 LINKS
      IF (INDEX .GT. 8000 ) GO TO 86
C     WRITE IN SORTED FILE-- IBM VERSION AND CDC VERSION
C****************  IBM  ************************
      WRITE (12'INDEX) (SFA(JJ), JJ=1,17)
C*********************************************
C
C****************  CDC  ***********************
C     CALL WRITMS(TFILE2,SFA,FRL,INDEX)
C*********************************************
C  UPDATE POINTER
      LOCAD (IIX, IIY) = INDEX + 1
      GO TO 500
  600 CONTINUE
      GO TO 610
   86 PRINT 7001
      STOP
  610 CONTINUE
      REWIND TFILE1
C     M = NUMBER OF LINKS WITHIN 25 X 25 GRID
      NTLNK=M
      DO 800 INDEX=1,NTLNK
C********************IBM***************************
      READ (12'INDEX) (SFA(JJ), JJ=1,17)
C
C******************  CDC  ***********************
C     CALL READMS(TFILE2,SFA,FRL,INDEX)
C*********************CDC************************
      ID1=SFA(1)
      ID2=SFA(2)
      LAND=SFA(8)
      IAREA=SFA(9)
      IFAC=SFA(10)
      LOCL=SFA(14)
      LU=SFA(15)
      LAR=SFA(16)
      LFC=SFA(17)
      WRITE(TFILE1,6010) ID1,ID2,(SFA(M1),M1=3,7),LAND,IAREA,IFAC,(SFA(M
     12),M2=11,13),LOCL,LU,LAR,LFC
 800  CONTINUE
      REWIND TFILE1
 7001 FORMAT(62H1  TOO MANY LINKS, REDEFINE DIMENSIONS IN REFILE. RUN ST
     1OPPED. )
C      RETURN
       END
```

```
      SUBROUTINE BIGLNK
C***************************************************************
C
C     PROGRAM TO SORT AND STORE THE LARGEST TRAFFIC LINKS.
C     LARGE LINKS ARE STORED IN ARRAYS IN COMMON /CDAT2/ (SUBROUTINE ZAVE).
C     SMALL LINKS ARE GRIDDED AS SECONDARY TRAFFIC (SUBROUTINE SEXTOR).
C     LINKS ARE SORTED ACCORDING TO A MAXIMUM NUMBER DESIRED (NCUT) OR
C     ACCORDING TO A MINIMUM TRAFFIC VOLUME (VMTMIN).--JONES
C
C
      REAL LENGTH,LEN
      INTEGER AREA,ARE,AR,FC
      INTEGER TFILE1,TFILE2,TFILE0
      DIMENSION BIN(27),IFBIN(26)
      COMMON /INOUTS/NCARD1,NCARD,NCARD2,NCARDR,NOUT,TFILE0,TFILE1,
     1TFILE2,NCARDX,NCARDW,INPT,IDISK
      COMMON /ODDEND/NTLNK,IYEAR,IHOUR,IDAY,ISEA
      COMMON /QUSTN1/YES,QPIN,QPGD1,QPGD2,QPGDT,QPFILE,QPOL(3),QAPRAC,
     1QSEC,QCAPR,QHRVOL,QFHWA,QSPD,ALT,CALIF,AREAID,QSTRT,
     2QISMAP,QMIX,NWIND,LCODE
      COMMON /QUSTN2/QBIG,VMTMIN,QRFILE,NCUT,MDIM
      COMMON /TFCSTF/ADJSPD(2,5,24),DEFCAP(2),DTRAF(2,12,24),
     1DTRAF2(3,24),TRAF2(25,25),SPD(2,5),SEASON(4),EMIS(3,6,20),AVGSP2,
     2TVMT2
      COMMON /GG/NGRIDE,NGRIDN,GSIZE,ORIGE,ORIGN,GVERT
      DATA BIN/-1.,1000.,2000.,3000.,4000.,5000.,6000.,
     17000.,8000.,9000.,10000.,12000.,13000.,14000.,15000.,
     216000.,17000.,18000.,19000.,20000.,30000.,50000.,80000.,
     3100000.,200000.,300000.,999999./
      DATA NO/3HNO /
C
C     READ IN ALL LINK DESCRIPTIONS.  SORT INTO TRAFFIC BIN ACCORDING
C     TO VOLUME
      NFB=26
      IF(VMTMIN.GT.0.) NCUT=NTLNK
      IF(VMTMIN.GT.0.) GO TO 306
 10   DO 22 N=1,NTLNK
C**********IBM**************************
      READ(TFILE1,6001,END=21) ID1,ID2,A1,B1,A2,B2,LENGTH,LANDUS,
     1AREA,IFAC,VOL1,VOL2,CAP,LOCL,LU,AR,FC
C
C**********CDC**************************
C     READ(TFILE1,6001,END=10000) ID1,ID2,A1,B1,A2,B2,LENGTH,LANDUS,
C    1          AREA,IFAC,VOL1,VOL2,CAP,LOCL,LU,AR,FC
C0000 IF(EOF(TFILE1)) 21,12,21
   12 SUM=VOL1+VOL2
      IF(LENGTH.GT.0.) GO TO 15
      IFBIN(NFB) = IFBIN(NFB) +1
      GO TO 22
   15 DO 20 I=1,NFB
```

```
      I2=I+1
      B2=BIN(I2)
      IF(SUM.GT.B1.AND.SUM.LE.B2) IFBIN(I)=IFBIN(I)+1
   20 CONTINUE
C     GO TO 10
   22 CONTINUE
   21 REWIND TFILE1
C
C     TOTAL NUMBER OF LINKS IN EACH TRAFFIC-VOLUME BIN (LARGEST TO
C     SMALLEST BIN).  WHEN NUMBER OF LINKS EXCEEDS NCUT, SET VMTMIN
C     EQUAL TO LAST BIN VALUE.
      J=NFB
      JTB=0
      DO 25 I=1,NFB
      JTB=JTB+IFBIN(J)
      IF(JTB.GE.NCUT) GO TO 29
      J=J-1
   25 CONTINUE
   29 IF(JTB.EQ.NCUT) GO TO 305
      IF(JTB.GT.NCUT) VMTMIN=BIN(J+1)
      NCUT=JTB-IFBIN(J)
      IF(NCUT.GT.87) GO TO 86
      GO TO 306
  305 VMTMIN=BIN(J)
  306 INDEX=0
C
C     READ IN LINK DESCRIPTION DATA.  IF VOLUME OF TRAFFIC GREATER
C     THAN VMTMIN, SAVE LINK DATA (CALL ZAVE).  IF VOLUME LESS THAN
C     VMTMIN, INCLUDE AS SECONDARY TRAFFIC EMISSIONS (CALL SEXTOR).
 31   DO 33 N=1,NTLNK
C**********IBM**************************
      READ(TFILE1,6001,END=39) ID1,ID2,A1,B1,A2,B2,LENGTH,LANDUS,
     1AREA,IFAC,VOL1,VOL2,CAP,LOCL,LU,AR,FC
C
C**********CDC**************************
C     READ(TFILE1,6001,END=10001) ID1,ID2,A1,B1,A2,B2,LENGTH,LANDUS,C      C
C    1           AREA,IFAC,VOL1,VOL2,CAP,LOCL,LU,AR,FC
C0001 IF(EOF(TFILEC)) 39,32,39
   32 IF(LENGTH.LT.0.) GO TO 35
      SUM=VOL1+VOL2
      IF(SUM.GT.VMTMIN) GO TO 35
      CALL SEXTOR(A1,B1,A2,B2,LENGTH,SUM,TRAF2,TVMT2)
      GO TO 33
   35 INDEX=INDEX+1
      IF(INDEX.GT.MDIM) GO TO 33
      LENGTH=ABS(LENGTH)
      CALL ZAVE(A1,B1,A2,B2,E,LENGTH,LANDUS,AREA,IFAC,VOL1,
     1VOL2,CAP,LOCL,INDEX,NCUT)
   33 CONTINUE
      WRITE(NOUT,6014) INDEX,VMTMIN
      IF(INDEX.GT.MDIM) GO TO 86
      IF(INDEX.GT.NCUT) GO TO 86
      IF(QRFILE.EQ.NO) GO TO 42
      WRITE(NOUT,6002)
   39 DO 40 J=1,INDEX
      CALL GETZ(J,X1,Y1,X2,Y2,LEN,LUS,ARE,IFC,V1,V2,CP,LC)
      WRITE(NOUT,6003) X1,Y1,X2,Y2,LEN,LUS,ARE,IFC,V1,V2,CP,LC,E
   40 CONTINUE
   42 NTLNK=INDEX
      NCUT=INDEX
      GO TO 90
   86 WRITE(NOUT,6013) INDEX,NCUT,VMTMIN,MDIM
      STOP333
 6001 FORMAT(BZ,2I5,4F8.4,F5.2,3I1,3F8.0,1X,4I1)
 6002 FORMAT(7X,2HA1,8X,2HB1,8X,2HA2,8X,2HB2,8X,3HLEN,4X,6HLANDUS,
     15X,4HAREA,6X,4HIFAC,6X,4HVOL1,6X,4HVOL2,6X,3HCAP,6X,4HLOCL/)
 6003 FORMAT(1X,5F10.0,3(I7,3X),3F10.0,I7,F12.2)
 6013 FORMAT(1X,14HERROR--INDEX= ,I10,7H NCUT= ,I10,6H VMT= ,F12.1,
     17H MDIM= ,I10)
 6014 FORMAT(1X,I8,26H LINKS STORED WITH VMT GT ,F10.2)
   90 CONTINUE
C     RETURN
      END
      SUBROUTINE SEXTOR(A1,B1,A2,B2,LEN,SUM,GRAF2,TVMT2)
C
C     THIS SUBROUTINE GRIDS AS SECONDARY TRAFFIC THE LINKS THAT
C     FALL BELOW MINIMUM VOLUME (VMTMIN).  CALLS GRID.--JONES
      REAL LEN
      DIMENSION IX(50),IY(50),FF(50),GRAF2(25,25)
      COMMON /GG/NGRIDE,NGRIDN,GSIZE,ORIGE,ORIGN,GVERT
C
      TAVMT=SUM*LEN
      CALL GRID(A1,B1,A2,B2,GSIZE,MM,IX,IY,FF)
      DO 125 K=1,MM
      I = IX(K)
      J = IY(K)
      IF(I.GT.NGRIDE.OR.J.GT.NGRIDN) GO TO 125
      IF(I.LT.1.OR.J.LT.1) GO TO 125
C
C     ACCUMULATING SMALLER LINKS AS GRIDDED SECONDARY TRAFFIC--
C     EXPRESSED AS A FRACTION OF THE TOTAL TRAFFIC NOT READ AS INDIVIDUAL
C     LINKS (TVMT2)
      GRAF2(I,J)=GRAF2(I,J)+(FF(K)*TAVMT)/TVMT2
  125 CONTINUE
      RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE DIFMOD
C*********************************************************************
C
C     THIS PROGRAM CALLS THE CONTROLLING ROUTINE FOR MOST DIFFUSION
C     COMPUTATIONS.  IF THE INTERSECTION MODEL IS TO BE USED, THOSE
C     ROUTINES ARE CALLED.  FINALLY, CONCENTRATIONS ARE PRINTED.--SIMMON
C
C
      COMMON/INOUTS/NCARD1,NCARD,NCARD2,NCARDR,NOUT,TFILE0,TFILE1,TFILE2
     1,NCARDX,NCARDW,INPT,IDISK
      COMMON/SFC/IWD(24),WS(24),ICLD(24),ITEMP(24)
      COMMON/CLINE/IJLOC(8),IJSPD(8)
      COMMON/QUSTN1/YES,QPIN,QPGD1,QPGD2,QPGDT,QPFILE,QPOL(3),QAPRAC,QSE
     1C,QCAPR,QHRVOL,QFHWA,QSPD,ALT,CALIF,AREAID,QSTRT,QISMAP,QMIX
     2,NWIND,LCODE
      COMMON /OVRLAY/ XR(625),YR(625),ISTABL(24),LDIR(625),
     1LSPD(625),KHR1,LASTHR,NRECP,KPOL,CPUD,NDATE,MSTA(3),NNHR,HT,JI,
     2HMIX(25),IDOFRC(625),CON(625)
      IF(QISMAP.EQ.YES .AND. NRECP.GT.1) GO TO 100
C**********CDC*************************
      CALL DIFF
      GO TO 10
C**********IBM*************************
C      CALL DIFF
C**************************************
   10 CONTINUE
      IF(QISMAP.NE.YES) GO TO 20
C**********CDC*************************
      CALL INT
      GO TO 20
C**********IBM*************************
C     CALL INT
C**************************************
   20 CONTINUE
C
C
C     PRINT RESULTS
C
C
C
C
      IF(NRECP.GT.10) GO TO 550
      WRITE(NOUT,6011)NDATE,CPUD,MSTA
      WRITE (NOUT,6012) (J, J=KHR1,LASTHR)
      WRITE (NOUT,6031) (ICLD(J), J=KHR1,LASTHR)
      WRITE (NOUT,6032) (ITEMP(J), J=KHR1,LASTHR)
      WRITE (NOUT,6021) ( ISTABL(J), J=KHR1,LASTHR)
      WRITE(NOUT,6022)(  HMIX( J ), J =KHR1,LASTHR)
C
C     PRINTING HEADER AND IDENTIFICATION INFORMATION
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C
      DO 500 MRECP=1,NRECP
      JJ1 =(MRECP-1)*NNHR + 1
      JJ2=JJ1+NNHR-1
      WRITE (NOUT,6013) IDOFRC(MRECP),(LSPD(J), J=JJ1,JJ2)
      WRITE (NOUT,6026) (LDIR(J), J=JJ1,JJ2)
      WRITE (NOUT,6027) (CON(J), J=JJ1,JJ2)
      IF(MOD(MRECP,10).NE.0) GO TO 500
      WRITE(NOUT,6011) NDATE,CRUD,MSTA
      WRITE(NOUT,6012)(IHR,IHR=KHR1,LASTHR)
  500 CONTINUE
      GO TO 86
  550 WRITE (NOUT,8011) NDATE, CRUD,MSTA
      NEWPG=150
      DO 575 M=1,NRECP,15
      IF(M.GT.NEWPG)WRITE(NOUT,8011)NDATE,CRUD,MSTA
      MP14=M+14
      IF(M.GT.NEWPG)NEWPG=NEWPG+150
      IF(MP14.GT.NRECP)MP14=NKECP
      WRITE (NOUT,6023) (IDUFKC(K), K=M,MP14)
      WRITE (NOUT,6029) (LSPD(K), K=M,MP14)
      WRITE (NOUT,6030) (LDIR(K), K=M,MP14)
      WRITE (NOUT,6028)  CRUD, (CON(K), K=M,MP14)
  575 CONTINUE
      WRITE(NOUT,6024)JI,HT
      GO TO 86
 6008 FORMAT(1H1,27HTOO MANY HOURS OR RECEPTORS)
 6011 FORMAT(1H1,I6,4X,A3, 3A4/97H  CONCENTRATIONS (CO=100-UG/M3,HC=10-U
     1G/M3,NOX=UG/M3) LOCAL WIND SPEEDS/DIRECTIONS (M/S, DEG)--   //50X,
     25HHOURS)
 6012 FORMAT (1H ,7X, 24(I4,1X))
 6013 FORMAT (12H0    STATION ,I5/ 8H WND SPD ,24I5)
 6021 FORMAT(8H STAB.   ,24I5)
 6022 FORMAT(8H MIX HT ,24F5.0)
 6023 FORMAT(21H0 STATION ID NO.     ,15I6)
 6024 FORMAT(20H0   STABILITY CLASS= ,I1,12H MIXING HT.= ,F6.0,1HM )
 6026 FORMAT(8H WND DIR  ,24I5)
 6027 FORMAT(8H CONCEN  ,24F5.0)
 6028 FORMAT(1H  ,A3,17H CONCENTRATIONS ,,15F6.0)
 6029 FORMAT(21H LOCAL WIND SPD--M/S  ,15I6)
 6030 FORMAT(21H LOCAL WINDDIR--DEG. ,15I6)
 6031 FORMAT(8H CLOUD   ,24I5)
 6032 FORMAT(8H TEMP--K ,24I5)
 8011 FORMAT(1H1,I6,4X,A3, 3A4/97H    CONCENTRATIONS (CO/HC IN 10-UG/M3-
     1--NOX IN UG/M3) LOCAL WIND SPEEDS/DIRECTIONS (M/S, DEG)--   //)
  100 WRITE(NOUT,6008)
   86 CONTINUE
C     RETURN
      END
      SUBROUTINE DIFF
C***********************************
C
C     CONTROLS READING OF INPUTS FOR CONCENTRATION CALCULATIONS AND THE
C     CALLING OF SUPPLEMENTAL METEOROLOGICAL,EMISSIONS AND DIFFUSION ROU-
C     TINES--- LUDWIG
C
      DIMENSION XW(100),YW(100),CRAP(3),
     2UPWNDC(3,16),WINDSP(100,24),WINDIR(100,24),
     3IDOFW(100)
      COMMON /OVRLAY/ XR(625),YR(625),ISTABL(24),LDIR(625),
     1LSPD(625),KHR1,LASTHR,NRECP,KPOL,CRUD,NDATE,MSTA(3),NNHR,HT,JI,
     2HMIX(25),IDOFRC(625),CON(625)
      COMMON/DIMINT/ZCONST,HEIGHT(8),NLANE(8),XII1(4),YII1(4),XII2(4),YI
     1I2(4)
      COMMON/CSTAB/SP180,CP180
      COMMON /DAYLYT/ LOCDHR, LOCTYM
      COMMON/HMM/POP4,P(25),T(25),MAXT,MINT,HMAX,HMIN,NSL,SAP
      COMMON/ODDEND/NTLNK,IYEAR, IHOUR, IDAY,ISEA
      COMMON/TFCSTF/ADJSPD(2,5,24),DEFCAP(2),DTRAF(2,12,24),DTRAF2(3,24)
     1,TRAF2(25,25),SPD(2,5),SEASON(4),EMIS(3,6,20),AVGSPZ,TVMTZ
      COMMON/SFC/IWD(24),WS(24),ICLD(24),ITEMP(24)
      COMMON/XY/X1(8),X2(8),Y1(8),Y2(8)
      COMMON/QUSTN1/YES,QPIN,QPDG1,QPDG2,QPGDT,QPFILE,QPOL(3),QAPRAC,QSE
     1C,QCAPR,QHRVOL,QFHWA,QSPD,ALT,CALIF,AREAID,QSTRT,QISMAP,QMIX
     2,NWIND,LCODE
      COMMON/CLINE/IJLOC(8),IJSPD(8)
      COMMON/MIX/ISTA,IYR,IMO,IDA,DAY,IDS,IHD,IST,IDATE,IDATE1,IDATE9
      COMMON/INOUTS/NCARD1,NCARD,NCARD2,NCARDR,NOUT,TFILE0,TFILE1,TFILE2
     1,NCARDX,NCARDW,INPT,IDISK
      COMMON/QUSTN2/QBIG,VMTMIN,QRFILE,NCUT,MDIM
      COMMON/COMING/TF(20),CORFAC(20,20,2),EMIDLE(2)
      DATA CRAP/3HHC ,3HCO ,3HNOX/
      DATA QNO/3HNO /
      ITFYL=14
      READ (INPT,6025,END=10000) IYEAR
C
C     THE FOLLOWING STATEMENTS READ THE EMISSION FACTORS COMPUTED
C     BY THE EMISSIONS PREPROCESSOR
C
10000 LOCDHR = 0
 9    DO 10 I=1,3
      QPOL(I) = QNO
   10 CONTINUE
      WINDIR(1,24)=27.
      WDAGO=27.
      READ(NCARD1,6001,END=10001)SLAT,POP,XXT,YYT
10001 IF(QPIN.EQ.YES)WRITE(NOUT,7001) SLAT,POP,XXT,YYT
      POP4 = (1000000.0*POP)**0.25
      P180 = 0.0174533*SLAT
      CP180 = COS(P180)
C
C     SLAT=LATITUDE(DEGREES NORTH)OF CITY
C     POP=POPULATION OF CITY (MILLIONS OF PEOPLE)
C     XXT,YYT=COORDINATES OF CITY CENTER(KM)
C
      READ(NCARD1,6002,END=10002)NRECP
10002 IF(NRECP.LE.625) GO TO 21
      WRITE(NOUT,6008)
      STOP
C
C     NRECP=NUMBER OF RECEPTORS TO BE TREATED, MAX=625
C
   21 READ(NCARD1,6003,END=10003)((IDOFRC(II),XR(II),YR(II)),II=1,NRECP)
C
C     XR,YR=RECEPTOR COORDINATES (KM)
C
10003 IF(QPIN.EQ.YES)WRITE(NOUT,7002)NRECP
      IF(QPIN.EQ.YES)WRITE(NOUT,7003) (IDOFRC(II),XR(II),YR(II),II=1, NR
     1ECP)
      READ(NCARD1,6002,END=10004)NWND
C
C     NWND=NUMBER OF WIND SITES
C
10004 READ(NCARD1,6003,END=10005)((IDOFW(II),XW(II),YW(II)),II=1,NWND)
10005 IF(QPIN.EQ.YES)WRITE(NOUT,7004) NWND
      IF(QPIN.EQ.YES)WRITE(NOUT,7003)(IDOFW(II),XW(II),YW(II),II=1,   NW
     1ND)
C
C     XW,YW=COORDINATES(KM) OF WIND SITES
C
      READ(NCARD1,6014,END=10006)QSTRT,QISMAP
10006 IF(QPIN.EQ.YES)WRITE(NOUT,7005)QSTRT,QISMAP
C
C     QISMAP=YES--SPECIAL LINE SOURCE MODEL USED
C     QSTRT=YES--STREET CANYON MODEL TO BE USED
      IF(QSTRT.EQ.YES.AND.QISMAP.EQ.YES) GO TO 23
      GO TO 25
   23 WRITE(NOUT,6015)
      STOP
   25 IF(QSTRT.EQ.YES)READ(NCARD1,6016,END=10007)STHT,STWDTH,STRTXX,STRT
     1ZZ,LOCST,STVOL,SPEEDS,STDIR,CAPCAN
10007 IF (QPIN.EQ.YES.AND.QSTRT.EQ.YES)WRITE(NOUT,7006)STHT, STWDTH,
     1 STRTXX,STRTZZ, LOCST, STVOL, SPEEDS, STDIR, CAPCAN
C     READING STREET CANYON PARAMETERS
C     STHT=HEIGHT OF ST. CANYON (M)
C     STWDTH=WIDTH(M)
C     STRTXX,STRTZZ=DISTANCES (HORIZ., VERT.) RECEPTOR TO NEAREST
C     TRAFFIC(M)
C     LOCST=AREA-FACILITY CODE
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C     SPEEDS=OFF-PEAK TRAFFIC SPEED (MPH)
C     STDIR=STREET DIRECTION, RECEPTOR IS TO RIGHT WHEN FACING THIS
C     DIRECTION. (DEG. CW FROM N)
C     CAPCAN=TWO-WAY TRAFFIC CAPACITY (VEH/HOUR)
      IF (QISMAP .NE. YES) GO TO 30
      READ(NCARD1,6017,END=10008) ZCONST, (HEIGHT(JJ),JJ=1,8), (NLANE(JJ
     +),JJ=1,8)
10008 READ(NCARD1,6018,END=10009) ((XII1(JJ), YII1(JJ),XII2(JJ),YII2(JJ)
     +), JJ=1,4)
C
C     READING INTERSECTION CHARACTERISTICS
C     ZCONST=INITIAL DISPERSION
C     HEIGHT=HEIGHT OF LANES ABOVE RECEPTOR(M)
C     NLANE=NO. OF LANES IN/OUT OF INTERSECTION
C     XII1,YII1,ETC.=COORDINATES OF LINK ENDS(0.01 MILE)
C
10009 IF(QPIN.EQ.YES)WRITE(NOUT,7007)ZCONST,(XII1(JJ),YII1(JJ),XII2(JJ),
     1YII2(JJ),JJ=1,4)
      IF(QPIN.NE.YES) GO TO 30
      DO 28 JJ=1,4
      JJP4=JJ+4
      WRITE(NOUT,7008)JJ,NLANE(JJ),HEIGHT(JJ),NLANE(JJP4),HEIGHT(JJP4)
   28 CONTINUE
   30 READ(NCARD1,6006,END=10010)NHOL
C
C     NHOL=DATE OF HOLIDAY
C
10010 READ(NCARD1,6005,END=   35)KHR1,LASTHR
C
C     KHR1,LASTHR=FIRST AND LAST HOURS OF CALCULATION
C
   35 READ(NCARD1,6004,END=10011)CRUD
10011 IF(QISMAP.NE.YES.OR.CRUD.NE.CRAP(3)) GO TO 36
      WRITE(NOUT,6035)
      STOP
C
C     CRUD=POLLUTANT TYPE-HC, CO, OR NOX
C
 36   DO 40 II=1,3
      KPOL=II
      IF(CRUD.EQ.CRAP(II)) GO TO 45
   40 CONTINUE
   45 QPOL(II)=YES
      READ(NCARD1,6007,END=10012) (UPWNDC(II,JJ),JJ=1,16)
C
C     UPWNDC=AVERAGE UPWIND CONCENTRATIONS(UG/M3), 16 DIRECTIONS
C
10012 IF(QPIN.EQ.YES)WRITE(NOUT,7009)NHOL,KHR1,LASTHR,CRUD,( UP
     1WNDC(II,JJ),JJ=1,16)
      READ(NCARD1,6004,END=10013)QMIX
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CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C     QMIX=MIXING DEPTH INPUT TYPE
C     --YES=DIRECT INPUT
C     --NO=CALCULATE FROM RADIOSONDE DATA
C
      CALL BASIC
C
C     COMPUTES BASIC GEOMETRIC QUANTITIES RELATED TO SECTORS
C
 175  IF(NRECP.GT.10) GO TO 65
      IF(QMIX.EQ.YES) GO TO 75
  70  CALL RAOBHM (IDSC,MSTA)
C
C     READS RADIOSONDE DATA AND CALCULATES MAXIMUM AND MINIMUM
C     MIXING HEIGHT
C
      GO TO 80
   75 READ(NCARDR,6009,END=10014) (HMIX(II),II=1,24)
10014 IF(QPIN.EQ.YES)WRITE(NOUT,7010)(HMIX(II),II=1,24)
      DO 66 II=1,24
      HMIX(II)=10.*HMIX(II)
   66 CONTINUE
C
C     MIXING HEIGHTS (HMIX) READ IN TENS OF METERS
C
      READ(NCARDR,6019,END=10015)MSTA,IDAT,MAXT,MINT,IDSC
10015 IF(QPIN.EQ.YES)WRITE(NOUT,7011)MSTA,IDAT,MAXT,MINT,IDSC
   80 CALL SFCOB1 (NCARDX)
      LOCDHR=LOCDHR+IDSC
C
C     READS FIRST HOUR WEATHER DATA
C
   85 CALL SFCOB2 (NCARDX)
C
C     READS REMAINING WEATHER DATA FOR DAY
C
      GO TO 110
 65   LASTHR=KHR1
      IF (QMIX .NE. YES) GO TO 90
      READ(NCARDR,6009,END=10016) (HMIX(KHR1))
10016 IF(QPIN.EQ.YES)WRITE(NOUT,7010) HMIX(KHR1)
      HMIX(KHR1)=10.*HMIX(KHR1)
      READ(NCARDR,6019,END=10017)MSTA,IDAT,MAXT,MINT,IDSC
10017 IF(QPIN.EQ.YES)WRITE(NOUT,7011)MSTA,IDAT,MAXT,MINT,IDSC
      LOCDHR=LOCDHR+IDSC
      CALL SFCOB1(NCARDX)
      CALL SFCOB2(NCARDX)
      GO TO 110
  90  CALL RAOBHM (IDSC,MSTA)
      CALL SFCOB1 (NCARDX)
      LOCDHR = LOCDHR + IDSC
C
C
  110 CONTINUE
      IF(NWND.EQ.1) GO TO 117
C     READING WIND DATA FOR MULTIPLE STATIONS
C
      DO 115 ISTA=1,NWND
      READ(NCARDW,6010,END=10018)((WINDSP(ISTA,IHR),WINDIR(ISTA,IHR)),IH
     1R=KHR1,   LASTHR)
10018 IF(QPIN.EQ.YES) WRITE(NOUT,7012) ISTA,(WINDSP(ISTA,IHR),         W
     1INDIR(ISTA,IHR),IHR=KHR1,LASTHR)
      DO 112 LMN=1,24
      IF(WINDIR(ISTA,LMN).LE.360.) GO TO 112
      WRITE(NOUT,6020)
      STOP
  112 CONTINUE
  115 CONTINUE
      GO TO 120
C
C     USING AIRPORT WINDS IF MULTIPLE WINDS NOT AVAILABLE
C
  117 WINDIR(1,1)=WINDIR(1,24)
      DO 119 KK=1,24
      WINDSP(1,KK)=WS(KK)
      IF(WS(KK).EQ.0.0) GO TO 118
      WINDIR(1,KK) = IWD(KK)
      GO TO 119
  118 KKM1=KK-1
C
C     WHEN WIND=0, PRECEDING HOUR DIRECTION IS USED
C
      IF (KKM1.LE.0) KKM1=24
      WINDIR(1,KK)=WINDIR(1,KKM1)
  119 CONTINUE
  120 IF(QISMAP .EQ. YES) CALL RETRAF(ITFYL,NCARD1,KHR1,LASTHR)
      NNHR=LASTHR-KHR1+1
      IF (QMIX .NE. YES) IDAT = 10000*IYR + 100*IMO + IDA
C
C        START HOUR LOOP
C
      DO 400 IHR=KHR1,LASTHR
      IF (QMIX .EQ. YES) GO TO 121
      IF (IHR .EQ. KHR1) IDAT = 10000*IYR + 100*IMO + IDA
  121 LLHR=IHR-KHR1+1
      IHOUR = IHR
      NDATE = IDAT
C
C     GETTING APPROX. JULIAN DATE
C
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      MMO = (IDAT-10000*MY)/100
      MDA = IDAT - 10000*MY - 100*MMO
      XMO = MMO
      XDA = MDA
      DAY = 30.5*(XMO-1.) + XDA
C
C     CALCULATING STABILITY CLASS AND MIXING DEPTH FOR THE HOUR
C
      CALL STABLE(IHR,SAS,ISTABL)
      IF (OMIX .EQ. YES) GO TO 123
      CALL DEPTH(IHR,SAS, HMIX ,KHR1,LASTHR, IDSC, MSTA)
C
C     GETTING AREA AVERAGE WIND--TO BE USED IF LOCAL WIND SPEED=0.
C
  123 JI = ISTABL(IHR)
      HT= HMIX (IHR)
      CALL WDBAR(WDBAR1,WDAGO,WINDSP,WINDIR,IHR,NWND)
      LOCTYM=IHR+LOCDHR
      IF(LOCTYM.LT.1)LOCTYM=1
      IF(LOCTYM.GT.24)LOCTYM=24
      IDAY=NDAYWK(IDAT)
C     CHECK FOR HOLIDAY (EQUIVALENT TO SUNDAY)
      LHOL = NHOL+ 10000*IYR
      IF (LHOL .NE. IDAT) GO TO 130
      IDAY = 1
  130 ISEA = NSEAS(IDAT)
      CALL EMOD
  135 DO 300 MRECP=1,NRECP
      CALL MARIAH(NWND,XW,YW,WINDIR,WINDSP,XR(MRECP),YR(MRECP),IHR,WWD,
     2WWS)
C
C     CALCULATING WIND SPEED (WS) AND DIRECTION (WD) AT SITE
C
      IF(WWS.EQ.0.0)WWD=WDBAR1
      IF(WWS.LT.1.0)WWS=1.0
C
C     USING AVERAGE OR PAST WIND DIRECTION IF SPEED=0--MIN, SPEED=1M/S
C     FOR SHORT LIST SKIP TRANSFER OF LINK
      IF(QBIG.EQ.YES) GO TO 137
C
      CALL LOCLNK(XR(MRECP),YR(MRECP),MDIM)
C
C     TRANSFERS APPROPRIATE LINK EMISSIONS TO CORE FROM TFILES
C
 137  CALL CALXOQ(HT,JI)
C
C     CALCULATING EMISSIONS
C
  145 CALL CALQUE (WWD,XR(MRECP) ,YR(MRECP) ,KPOL)
      CALL CALCON (CCON)
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C
C     CALCULATING CONCENTRATIONS
C     USING SPECIAL SUBROUTINES FOR ADJACENT ROAD
C
      CHI=0.0
      IF(QSTRT.NE.YES) GO TO 155
C
C     GETTING TRAFFIC VOLUME---FOR THE HOUR
C
  150 MOCST=LOCST
C       CHECK FOR SUN OR SAT
      IF (MOCST.EQ.1) MOCST=12
      IF (MOCST.EQ.7) MOCST=11
C       GET LOCALE/FACILITY CODE FOR EMMISSIONS
      LFC=0
      K=LOCST
      IF (K.GT.5) LFC=1
      IF (K.GT.5) K=K-5
      IF (K.GT.3) K=3
      LL=3*LFC+K
      VOLCAN=STVOL*0.5*(DTRAF(1,MOCST,LOCTYM)+DTRAF(2,MOCST,LOCTYM))*SEA
     1SON(ISEA)
C
C     GETTING STREET CANYON SPEEDS
C     IF (QCAPR .NE. YES) GO TO 151
      VV = VOLCAN/CAPCAN
      LLSP =(0.3333*SPEEDS*1.149/(1.0 + 0.15*VV*VV*VV*VV)) + 1.
      GO TO 152
C
C     3 MPH SPEED CLASS, AVER OF 2 DIRECTIONS
C
  151 LLSP=0.167*SPEEDS*(ADJSPD(1,MOCST,LOCTYM)+ADJSPD(2,MOCST,LOCTYM))+
     11.
  152 IF(LLSP.LT.2) LLSP=2
      IF(LLSP.GT.20) LLSP=20
C
C     GET SOURCE STRENGTH (UG/M-S)
C
      QQ=VOLCAN*(EMIS(KPOL,  LL ,LLSP)*0.1726)
      CALL STREET(WWS,WWD,STDIR,QQ,STRTXX,STRTZZ,STHT,STWDTH,CHI)
  155 JJ1= (MRECP-1)*NNHR + LLHR
C
C          ADDING UPWIND CONTRIBUTION
C
      RWD = IWD(IHR)
      JJWD = (RWD + 11.25)/22.5
      IF (JJWD .LE. 0) JJWD = 16
      CON(JJ1)=CHI+CCON + UPWNDC(KPOL,JJWD)
      LDIR(JJ1)=WWD+0.5
      LSPD(JJ1)=WWS+0.5
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C       CONVERTING HC TO 10-MICRGM/M3 AND CO TO 100-UG/M3 UNITS
C
      IF(KPOL.LE.2)CON(JJ1)=  0.1*CON(JJ1)
      IF (KPOL.EQ.2) CON(JJ1) = 0.1*CON(JJ1)
  300 CONTINUE
C
C     END RECEPTOR LOOP
C
  400 CONTINUE
C
C     END HOUR LOOP
C
   86 CONTINUE
 6001 FORMAT(BZ,40X,4F5.1)
 6002 FORMAT(BZ,40X,I3)
 6003 FORMAT(BZ,5X,I3,2F6.2,I3,2F6.2,I3,2F6.2,I3,2F6.2,I3,2F6.2)
 6004 FORMAT(BZ,40X,A3)
 6005 FORMAT(BZ,40X,2I5)
 6006 FORMAT(BZ,30X,I5)
 6007 FORMAT(BZ,40X,8F5.2)
 6008 FORMAT(1H1,27HTOO MANY HOURS OR RECEPTORS)
 6009 FORMAT(BZ,8(3F3.0,1X))
 6010 FORMAT(BZ,8(F4.0,F6.0))
 6014 FORMAT(BZ,40X,2(A3,7X))
 6015 FORMAT(1H1,55HSTREET CANYON AND LINE SOURCE MAY NOT BE USED TOGETH
     1ER  )
 6016 FORMAT(BZ,40X,4F4.1,I2,F6.0,2F4.0,F6.0)
 6017 FORMAT(BZ,25X,9F4.0,8I2)
 6018 FORMAT(BZ,16F5.0)
 6019 FORMAT(BZ,3A4,I8, 3I5)
 6020 FORMAT(1H1,20HBAD WIND DIRECTION   )
 6025 FORMAT (BZ,I4)
 6035 FORMAT(1H1,37HCANNOT RUN INTERSECTION MODEL FOR NOX)
 7001 FORMAT(14H0   LATITUDE = ,F5.1,5H DEG. /17H    POPULATION =  ,F5.1
     1,8H MILLION /29H    CENTER-CITY COORDINATES-- ,F5.1,7HKM. N,  ,F5.
     21,5HKM. E  )
 7002 FORMAT(21H0   NO. OF RECEPTORS= ,I3,48H--THEIR ID'S AND COORDINATE
     1S (X,Y--KM.) FOLLOW-- )
 7003 FORMAT(6(5X,I3,2F6.2))
 7004 FORMAT(21H0   NO. OF WIND STA.= ,I3,48H--THEIR ID'S AND COORDINATE
     1S (X,Y--KM.) FOLLOW-- )
 7005 FORMAT(30H    STREET CANYON MODEL USED--,A3/
     136H    TRAFFIC/LINE-SOURCE MODEL USED--,A3)
 7006 FORMAT(36H0   HT. AND WIDTH OF ST. CANYON (M)= ,2F8.2/50H    INLET
     1 HORIZ. AND VERT. DIST. (M) FROM TRAFFIC= ,2F8.2/13H    ST. TYPE=
     2,I2/4H    ,F8.0,16H VEHICLES/DAY AT ,F4.0,15H-MPH (OFF-PEAK) /53H
     3   ST. DIRECT. (DEG. CW FROM N--RECEPTOR TO RIGHT)= ,F5.0/18H TWO-
     4WAY CAPACITY= ,F6.0,9H VEH./HR. )
 7007 FORMAT(48H0   INITIAL DISPERSION IN LINE-SOURCE MODEL (M)= ,F4.1//
     198H    X-Y COORDINATES (0.01 MILE) FOR EACH END OF EACH OF THE 4 S
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7008 FORMAT(1H0,9H    LINK  ,I1,5H HAS ,I1,14H INBOUND LANES ,F6.2,25H-
    1M ABOVE THE RECEPTOR AND ,I2,12H OUTBOUND AT ,F6.2)
7009 FORMAT(14H0   HOLIDAY-- ,I8/18H    1ST/LAST HOURS ,2I4/39H    A
    1VERAGE UPWIND CONC. (UG/M3) OF ,A3,       25HFOR 16 DIRECT. (1=NNE
    2)--  / (16F7.0/))
7010 FORMAT(60H0   HOURLY VALUES OF MIXING HT. (TENS OF METERS) AS INPU
    1T--  /5X,24F5.0)
7011 FORMAT(4H0    ,3A4,1H, ,I7,20H, MAX/MIN TEMPS (F)= ,I3,1H/,I3,25H -
    1-TIME CHANGE CORRECTOR= ,I2)
7012 FORMAT(87H0   HOURLY WIND SPEEDS (M/S) AND DIRECTIONS (DEG) FROM 1
    1ST THROUGH LAST HOURS, SITE NO. ,I3,3H--  /12(F5.1,F5.0)/12(F5.1,F
    25.0))
7013 FORMAT (33H0 DIRECT INPUT OF MIXING DEPTH --  ,A3)
C
C     RETURN
C
      END
      SUBROUTINE CALQUE(WWD,XPT,YPT,IPOL)
C
C THIS SUBROUTINE COMPUTES THE CO EMISSION  WITHIN EACH SECTOR SEGMENT.
C        --- MANCUSO
C
      DIMENSION Y(20),X(20),IY(20),JY(20)
      COMMON/CSTM/VCAR(10),AST(10),WWST(10),ICST(10),NOCD(10)
      COMMON/QUE/QL(10),Q(10),XUQ(10),SA,CA
      COMMON/CLDAT/X1(1200),Y1(1200),X2(1200),Y2(1200),E(1200),NEARNO
      COMMON/ALLC/YS(351),IYN(351),XR(10),YR(10),AR(10),ARI(10),ACR,LR4,
     1LR5,LR9,LR10,AG,YC1,YC2,XRC,YRC,XC2,BY2,BY1,BI2,BI1,CRI,CR,LRL,CB(
     23),SB(3),AI9,SI3
      CON=1.0/3600.0
C     FOR CONVERTING TO MICRO GRAMS PER SECOND
      IWD=WWD
      YG=YPT
      XG=XPT
      ANG=ACR*IWD
       CA=COS(ANG)
       SA=SIN(ANG)
      DO 210 I=1,9
  210 Q(I)=0.0
C
C  BEGINNING OF LOOP FOR COMPUTING EMISSION WITHIN EACH SECTOR SEGMENT.
      DO 300 NC=1,NEARNO
C
C  TRANFORMATION OF COORDINATES.
 221  XD1=X1(NC)-XG
      YD1=Y1(NC)-YG
      XD2=X2(NC)-XG
      YD2=Y2(NC)-YG
      IYT=0
      YS1=XD1*SA+YD1*CA
      YS2=XD2*SA+YD2*CA
      IF (YS1.LT.YS2)GO TO 216
      YSS=YS1
      YS1=YS2
      YS2=YSS
      IYT=1
 216  IF (YS2.LT.0.OR.YS1.GT.YC1)GO TO 300
      JY(2)=0
      JY(1)=JY(2)
      XS1=XD1*CA-YD1*SA
      XS2=XD2*CA-YD2*SA
      IF (IYT.EQ.0)GO TO 222
      XSS=XS1
      XS1=XS2
      XS2=XSS
C
C CHECK TO SEE IF LINK LIES WITHIN SECTOR.
```

```
      B1=B2
      IF (YS1.GT.YC2)GO TO 224
      B1=BY1
      IF (YS2.LT.YC2) B2=BY1
  224 IF (ABS(XS1).LT.B1*YS1)GO TO 230
      IF (ABS(XS2).LT.B2*YS2)GO TO 232
      IF (XS1*XS2.LT.0)GO TO 234
      IF (YS1.GT.YC2.OR.YS2.LT.YC2)GO TO 300
      IF (ABS(XS1).LT.XC2.OR.ABS(XS2).LT.XC2) GO TO 234
      GO TO 300
  230 IF (ABS(XS2).LT.B2*YS2)JY(2)=1
      JY(1)=1
      GO TO 234
  232 JY(2)=1
 234  X(1)=XS1
      X(2)=XS2
      Y(1)=YS1
      Y(2)=YS2
      YD=YS1-YS2+0.0001
       XD=XS1-XS2
      BL=XD/YD
       AL=XS1-BL*YS1
C
C  LOCATES THE SEGMENT WITHIN WHICH THE END POINTS OF THE LINK LIE.
      IF (YS1.GT.0)GO TO 236
      YS1=0.0
      Y(1)=YS1
      XS1=AL
      X(1)=XS1
      IF (XS1.EQ.0)JY(1)=1
 236  IY1=YS1*CRI+1
      IY2=YS2*CRI+1
      IF (IY2.GT.350)IY2=350
      IY(1)=IYN(IY1)
      IF (YS1.GE.YS(IY1))IY(1)=IY(1)+1
      IY(2)=IYN(IY2)
      IF (YS2.GT.YS(IY2))IY(2)=IY(2)+1
C
C  LOCATES THE INTERSECTIONS OF LINK WITH SECTOR DIVIDING LINES.
      N=2
      IF (IY(1).EQ.IY(2))GO TO 250
        L=IY(1)
  238 YP=YR(L)
       XP=AL+BL*YP
      IF (ABS(XP).GE.XR(L))GO TO 240
      N=N+1
      X(N)=XP
      Y(N)=YP
      IY(N)=L
      JY(N)=IY(N)
      N=N+1
      X(N  )=XP
      Y(N  )=YP
      IY(N  )=L+1
      JY(N  )=IY(N  )
  240 L=L+1
      IF (L.LT.IY(2))GO TO 238
C
C  LOCATES THE INTERSECTIONS OF LINK WITH SIDES OF SECTOR.
 250  K=1
  260 IF (ABS(X(K)).LT.BY2*Y(K))GO TO 280
      SBIII=1.0
      IF (X(K).LT.0.0)SBIII=-1.0
      BI3=SBIII*BI2
       XP=AL/(1.0-BL*BI3)
       YP=BI3*XP
      IF (YP.LT.YRC.OR.YP.GT.YC1)GO TO 270
      IYP=YP*CRI+1
      N=N+1
      IY(N)=IYN(IYP)
      IF (YP-YS(IYP))266,262,264
  262 IF (K.EQ.1) GO TO 264
      GO TO 266
  264 IY(N)=IY(N)+1
  266 X(N)=XP
      Y(N)=YP
      JY(N)=IY(N)
  270 IF (ABS(X(K)).LT.BY1*Y(K))GO TO 280
      BI3=SBIII*BI1
       XP=AL/(1.0-BL*BI3)
       YP=BI3*XP
      IF (YP.GT.YRC.OR.YP.LT.0)GO TO 280
      IYP=YP*CRI+1
      N=N+1
      IY(N)=IYN(IYP)
      IF (YP-YS(IYP))276,272,274
  272 IF (K.EQ.1) GO TO 274
      GO TO 276
  274 IY(N)=IY(N)+1
  276 X(N)=XP
      Y(N)=YP
      JY(N)=IY(N)
  280 K=K+1
      IF (K.LT.3)GO TO 260
C
C  COMPUTES EMISSION CONTRIBUTION OF LINK TO EACH SEGMENT
C      (RESULTS STORED IN W).
      DO 295 N1=1,N
      IF (JY(N1).EQ.0)GO TO 295
      NS1=IY(N1)
      NN1=N1+1
      DO 292 N2=NN1,N
      IF (JY(N2).EQ.0)GO TO 292
      NS2=IY(N2)
      IF (NS1.NE.NS2)GO TO 292
      XDN=X(N1)-X(N2)
      YDN=Y(N1)-Y(N2)
      XDD=XD1-XD2
      YDD=YD1-YD2
      QT=SQRT((XDN*XDN+YDN*YDN)/(XDD*XDD+YDD*YDD))*E(NC)
      Q(NS1)=Q(NS1)+QT
 290  JY(N2)=0.0
      GO TO 294
  292 CONTINUE
  294 JY(N1)=0
  295 CONTINUE
C
C  END OF MAIN LOOP
 300  CONTINUE
C
C  COMPUTES CO EMISSION WITHIN SEGMENTS FROM MINOR LINK DATA.
      CALL CALLOC(IPOL,XG,YG)
      DO 400 L=1,9
      Q(L)=(Q(L)*ARI(L)+QL(L)*AI9)*CON
  400 CONTINUE
      RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE LOCLNK(X,Y,MDIM)
C
C     THIS SUBROUTINE TRANSFERS TRAFFIC LINK INFORMATION FOR LINKS
C     WITHIN 3-KM OF RECEPTOR FROM TFILE3 TO CORE.--LUDWIG AND WHEELER
C
      DIMENSION SFA(1530)
      INTEGER FRL, TFILE3
      COMMON/CLDAT/X1(1200),Y1(1200),X2(1200),Y2(1200),E(1200),NEARNO
      COMMON/LINDEX/NUMLNK(25,25),LOCAD(25,25),LSQIDX(625)
C
C     FINDING INDICES FOR GRIDS WITHIN ONE OF RECPTOR
C
      TFILE3 = 13
      FRL=1530
      IXM1=X/3.
      IYM1=Y/3.
      IF(IYM1.LE.0)IYM1=1
      IF(IXM1.LE.0)IXM1=1
      IXP1=IXM1+2
      IYP1=IYM1+2
      IF(IYP1.GT.25)IYP1=25
      IF(IXP1.GT.25)IXP1=25
      NN=0
      DO 60 IX=IXM1,IXP1
      DO 60 IY=IYM1,IYP1
      INDEX3=LOCAD(IX,IY)
      IF(INDEX3.LE.0) GO TO 60
C*********IBM*************************************
      READ ( 13 ' INDEX3) (SFA(J),J=1,1530)
C***********************************************************************
C**********CDC************************************
C     CALL READMS(TFILE3,SFA,FRL,INDEX3)
C***********************************************************************
      DO 50 J=1,1530,5
      IF(SFA(J).LT.-900.) GO TO 55
      N1=J
      N2=J+1
      N3=J+2
      N4=J+3
      N5=J+4
      NN=NN+1
      IF(NN.GT.MDIM) GO TO 186
      X1(NN)=SFA(N1)
      Y1(NN)=SFA(N2)
      X2(NN)=SFA(N3)
      Y2(NN)=SFA(N4)
      E(NN)=SFA(N5)
   50 CONTINUE
   55 CONTINUE
   60 CONTINUE
```

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      GO TO 86
  186 PRINT 1
      STOP
    1 FORMAT(1H1,77HYOU NEED A LARGER DIMENSION FOR TEMPORARY LINK STORA
     1GE--SEE SUBROUTINE LOCLNK)
   86 CONTINUE
      RETURN
C**   THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE DEPTH(IT,SAS,MHS,KHR1,LASTHR, IDSC, MSTA)
C
C          THIS SUBROUTINE CALCULATES THE MIXING DEPTH FOR EACH
C     HOUR.  AT SUNSET, SUBROUTINES RAOBHMM AND SFCOBS1 ARE CALLED FOR
C     CALCULATIONS OF NIGHT-TIME MIXING DEPTHS. ---LUDWIG AND MANCUSO
C
C     IT=HOUR(LST)
C     SAS=SINE OF SOLAR ELEVATION
C     HT=MIXING HEIGHT(M)
C
      DIMENSION MHS(24), MSTA(3)
      REAL MHS
      COMMON/INOUTS/NCARD1,NCARD,NCARD2,NCARDR,NOUT,TFILE0,TFILE1,TFILE2
     1,NCARDX,NCARDW,INPT,IDISK
      COMMON /DEEPTH/IHRSS
      COMMON/DAY/IDW,NH,IDAHO,IHW,IDWT
      COMMON/MIX/ISTA,IYR,IMO,IDA,DAY,IDS,IHD,IST,IDATE,IDATE1,IDATE9
      COMMON/HMN/POP4,P(25),T(25),MAXT,MINT,HMAX,HMIN,NSL,SAP
      COMMON/SFC/IWD(24),WS(24),ICLD(24),ITEMP(24)
      DATA HSUN,HRSUN/1000.0,18.0/
      ITT= ITEMP(IT)
      IF (ITT.LT.MINT)ITT=MINT
C
C            IS IT DAYTIME (SAS GREATER THAN 0).
C
  610 IF(SAS.GE.0.0) GO TO 100
      IF (IT .LT. IHRSS) GO TO 130
      IF (IT .EQ. KHR1) ITT = ITEMP(IHRSS)
C
C     IS IT FIRST HOUR AFTER SUNSET(GO TO 105)
C
      IF (IT .EQ. KHR1) GO TO 105
      IF(SAP) 120,105,105
C          LINEAR TEMPERATURE INTERPOLATION IS USED TO CALCULATE THE
C     DAYTIME MIXING DEPTH.
 100  HT=HMIN+(ITT-MINT)*(HMAX-HMIN)/(MAXT-MINT)
      GO TO 132
 105  HT=HMIN+(ITT-MINT)*(HMAX-HMIN)/(MAXT-MINT)
      HSUN=HT
      HRSUN=IT
C
C        AT SUNSET, READ NEXT SOUNDING ANDCALCULATE MAX AND MIN MIXXING
C        HEIGHTS. READ NEXT DAY-S FIRST HOUR OF SFC DATA
  108 CONTINUE
  115 IF(LASTHR-KHR1) 116,135,116
  116 CALL RAOBHM (IDSC, MSTA)
      CALL SFCOB1 (NCARDX)
      GO TO 135
C
C          TIME INTERPOLATION IS USED TO CALCULATE THE MIXING DEPTH
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  120 IF(IT-15) 130,130,125
  125 IF(LASTHR-KHR1) 126,150,126
  150 CALL RAOBHM (IDSC, MSTA)
      CALL SFCOB1(NCARDX)
 126  HT=HMIN+(HSUN-HMIN)*(24-IT)/(24-HRSUN)
      GO TO 132
 130  HT=HMIN
  132 IF(LASTHR-KHR1) 135,108,135
 135  IF (HT.LT.50) HT=50.0
      SAP=SAS
      MHS(IT)=HT
      RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE RAOBHM (IDSC,MSTA)
C
C          THIS SUBROUTINE READS IN A HEADER CARD AND A RAOB SOUNDING
C     AND THE MAX AND MIN VALUES OF THE MIXING DEPTH ARE CALCULATED.
C     ---LUDWIG AND MANCUSO
C
      DIMENSION THETA(25) , MSTA(3)
      COMMON/INOUTS/NCARD1,NCARD,NCARD2,NCARDR,NOUT,TFILE0,TFILE1,TFILE2
     1,NCARDX,NCARDW,INPT,IDISK
      COMMON/MIX/ISTA,IYR,IMO,IDA,DAY,IDS,IHD,IST,IDATE,IDATE1,IDATE9
      COMMON/HMM/POP4,P(25),T(25),MAXT,MINT,HMAX,HMIN,NSL,SAP
      COMMON/QUSTN1/YES,QPIN,QPGD1,QPGD2,QPGDT,QPFILE,QPOL(3),QAPRAC,QSE
     1C,QCAPR,QHRVOL,QFHWA,QSPD,ALT,CALIF,AREAID,QSTRT,QISMAP,QMIX
     2,NWIND,LCODE
      INTEGER TFILE0,TFILE1,TFILE2
    1 FORMAT(/,1H ,40HHMIN DENOM IS ZERO IN SUBROUTINE RAOBHMM  )
    3 FORMAT(1X,3A4,6I5)
    4 FORMAT(18H0    RAOB INPUTS-- )
    5 FORMAT( BZ,3A4,2X,3I2,3I5)
 6    FORMAT(BZ,20X,1F6.1,13X,1F5.1)
C
C     READ IN HEADER CARD
      READ(NCARDR,5,END=10000)MSTA,IYR,IMO,IDA,MAXT,MINT,IDSC
10000 IF(QPIN.EQ.YES)PRINT 4
      IF(QPIN.EQ.YES)PRINT 3,MSTA,IYR,IMO,IDA,MAXT,MINT,IDSC
      TMAX = MAXT
      TMIN = MINT
C
C     ADJUST FOR CHANGE TO/FROM DAYLIGHT SAVING TIME
C
      IDS=IDS+IDSC
C
C     DAY=APPROX. JULIAN DATE
C
      DAY=30.5*(IMO-1)+IDA
C
C     CONVERT TO DEG. KELVIN
C
      TMAX=(TMAX-32.0)*0.5555+273.2
      TMIN=(TMIN-32.0)*0.5555+273.2
      MAXT = TMAX + 0.5
      MINT = TMIN + 0.5
C
C     READ RAOB DATA TO 500MB
C
      DO 25 L=1,25
      READ(NCARDR,6,END=10001)T(L),P(L)
10001 IF(QPIN.EQ.YES)PRINT 6,T(L),P(L)
      T(L)=T(L)+273.2
      IF(P(L).LE.500.0) GO TO 27
```

```
   27 NSL=L
C
C           DETERMINE THE PRESSURE LEVEL WHERE POTENTIAL TEMPERATURE
C     (THETA) IS GREATER THAN OR EQUAL TO THE SFC MAX VALUE.
   60 IF (TMAX .GE.T(1)) GO TO 80
 70   HMAX=0.0
      GO TO 120
C
C     CONVERT MAX. TEMP. TO POTENTIAL TEMP.
C
 80   TETMX=((1000.0/P(1))**0.286)*TMAX
      DO 105 I=1,NSL
      THETA(I)=T(I)*(1000.0/P(I))**0.286
      IF (THETA(I).LT.TETMX)GO TO 105
 100  IS=I
      GO TO 110
 105  CONTINUE
      HMAX=4000.0
      GO TO 120
C
C     CALCULATION OF MAX MIXING DEPTH BY INTERPOLATION BETWEEN LEVELS
C
 110  IS1=IS-1
      PM=P(IS1)+(P(IS)-P(IS1))*(TETMX-THETA(IS1))/(THETA(IS)-THETA(IS1))
      HMAX=14.7*(TMAX+T(IS))*ALOG(P(1)/PM)
      IF (HMAX.GT.4000.0)HMAX=4000.0
 120  TOP=(T(2)-T(1))/(P(2)-P(1))
      DEN=0.5*TOP*(P(2)+P(1))-0.143*(T(2)+T(1))
      IF (DEN.NE.0.0)GO TO 130
      WRITE(NOUT,1)
      STOP
C
C     CALCULATION OF MIN MIXING DEPTH.
 130  HMIN=-14.7*(T(2)+T(1))*((0.0633-0.298*TOP)/DEN)*POP4
      IF (HMIN.LE.0.0)HMIN=4000.0
      IF (HMIN.GT.4000.0)HMIN=4000.0
      IF (HMAX .LT. 50.0) HMAX = 50.0
 140  IF (HMAX.LT.HMIN)HMIN=HMAX
      RETURN
      END
      SUBROUTINE CALLOC(IPOL,XG,YG)
C
C           THIS SUBROUTINE USES THE GRID POINT VALUES (VCL AND VCM) TO
C     COMPUTE THE AVERAGE CO EMISSIONS WITHIN EACH SECTOR SEGMENT.  THE
C     RESULTS ARE STORED IN QL AND Q. ---MANCUSO
C
      COMMON/GRDEMS/EMISSN(3,25,25),SECEMS(3,25,25)
      COMMON/QUE/QL(10),Q(10),XOQ(10),SA,CA
      COMMON/ALLC/YS(351),IYN(351),XR(10),YR(10),AR(10),ARI(10),ACR,LR4,
     1LR5,LR9,LR10,AG,YC1,YC2,XRC,YRC,XC2,BY2,BY1,BI2,BI1,CRI,CR,LRL,CB(
     23),SB(3),AI9,SI3
      DIMENSION VCL(625),VCM(625)
      NCL=25
      NRW=25
      I=0
      DO 100 M=1,NRW
      DO 100 N=1,NCL
      I=I+1
      VCL(I)=    SECEMS(IPOL,N,M)
      VCM(I)=    EMISSN(IPOL,N,M)
  100 CONTINUE
      DO 30 L=1,9
      YRL=YR(L)
      XDS=0.0
      SEVM=XDS
      SEVL=SEVM
      LD=1
      KTN=LD
      IF (L.LT.5)GO TO 5
      KTN=3
       LD=L-3
 5    WCT=0.25/LD
      DO 20 J=1,LD
      FXDS=1.0-WCT*(1.0+2.0*(LD-J))
      YRR=YRL*FXDS
      SSEVL=0.0
      SSEVM=SSEVL
      DO 10 K=1,KTN
      DIVI=YRR/CB(K)
      YM=(DIVI*(CA*CB(K)-SA*SB(K))+YG)*SI3+ 0.5
      XM=(DIVI*(SA*CB(K)+CA*SB(K))+XG)*SI3+ 0.5
      IYM=INT(YM)
      IXM=INT(XM)
      IF (IYM.LT.1.OR.IYM.GE.NRW)GO TO 10
      IF (IXM.LT.1.OR.IXM.GE.NCL)GO TO 10
      DYM=YM-IYM
      DXM=XM-IXM
      IXY=(IYM-1)*NCL+IXM
      DYM1=1.0-DYM
      DXM1=1.0-DXM
      TTEVL=(DYM1*VCL(IXY)+DYM*VCL(IXY1))*DXM1
     1+(DYM1*VCL(IXY+NRW)+DYM*VCL(IXY1+NRW))*DXM
      SSEVL=SSEVL+TTEVL
      IF (L.LE.LRL)GO TO 10
      TTEVM=(DYM1*VCM(IXY)+DYM*VCM(IXY1))*DXM1
     1+(DYM1*VCM(IXY+NRW)+DYM*VCM(IXY1+NRW))*DXM
      SSEVM=SSEVM+TTEVM
   10 CONTINUE
      SEVL=SEVL+SSEVL*FXDS
      SEVM=SEVM+SSEVM*FXDS
      XDS=XDS+FXDS*KTN
   20 CONTINUE
      QL(L)=SEVL/XDS
      IF(L.GT.LRL)QL(L)=SEVM/XDS+QL(L)
   30 CONTINUE
      RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE WDBAR(WDBAR1,WDAGO,WINDSP,WINDIR,IHR,NWND)
C
C     THIS SUBROUTINE CALCULATES AVERAGE WIND DIRECTION FOR THE HOUR
C     WHEN MULTIPLE OBSERVATIONS ARE AVAILABLE.   ---LUDWIG
C     IF SPEED=0,PRECEDING VALUE IS USED.
C
      DIMENSION WINDSP(100,24),WINDIR(100,24)
      ACR=0.017453293
      IF (NWND.GT.1) GO TO 10
      WDBAR1=WINDIR(1,IHR)
      GO TO 86
C
C     VECTOR AVERAGES
C
   10 SUMU=0.
      SUMV=0.
      DO 100 ISTA=1,NWND
      IF(WINDSP(ISTA,IHR).LT.0.) GO TO 100
      SS=WINDSP(ISTA,IHR)
      DD=(270.-WINDIR(ISTA,IHR))*ACR
      SUMU=SUMU+SS*COS(DD)
      SUMV=SUMV+SS*SIN(DD)
  100 CONTINUE
      IF(SUMU.NE.0.) GO TO 110
      IF (SUMV.EQ.0.) GO TO 186
  110 DD=(4.7124-ATAN2(SUMV,SUMU) /ACR )
      ND=AMOD(DD,360.)+0.5
      WDBAR1=ND
      GO TO 86
C
C     PRECEDING HOUR-AVERAGE USED WHEN AVERAGE=0
C
  186 WDBAR1=WDAGO
   86 WDAGO=WDBAR1
      RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE BASIC
C
C     THIS SUBROUTINE COMPUTES AND STORES BASIC QUANTITIES USED
C     ELSEWHERE IN THE PROGRAM --- MANCUSO
C
      COMMON/ALLC/YS(351),IYN(351),XR(10),YR(10),AR(10),ARI(10),ACR,LR4,
     1LR5,LR9,LR10,AG,YC1,YC2,XRC,YRC,XC2,BY2,BY1,BI2,BI1,CRI,CR,LRL,CB(
     23),SB(3),AI9,SI3
      DATA ACV,RR,SSIZE /1.0,0.125,3.0/
      ACR=0.0174533
      CR=1.0
      HANG=0.196349625
      LR4=4
      LR9=9
      LRL=5
      TN1125=TAN(HANG)
      CRI=10.0/CR
      AI9=1.0/(SSIZE*SSIZE)
      SI3=1.0/SSIZE
      LR5=LR4+1
      LR10=LR9+1
      A75=0.833*HANG
      CB(1)=1.0
      CB(3)=COS(A75)
      CB(2)=CB(3)
      SB(1)=0.0
      SB(2)=SIN(-A75)
      SB(3)=-SB(2)
C
C     COMPUTES GEOMETRIC QUANTITIES FOR SECTOR SEGMENTS
C     AR(I)=AREA OF ITH SEGMENT--ARI(I)=ITS INVERSE
C     YR(I)=MAX DISTANCE OF ITH SEGMENT FROM RECEPTOR
C     XR(I)=MAX HALF WIDTH OF SEGMENT
C     LR4 AND LR9=NO. OF SEGMENTS IN SMALLER AND TOTAL SECTOR.
      DO 210 L=1,10
      AG=11.25
      IF(L.LT.5) AG=22.5
      AG=ACR*AG
      TANAG=TAN(AG)
      YR(L)=SQRT(RR*RR*AG/TANAG)
      XR(L)=YR(L)*TANAG
      IF(L.EQ.LRL)YC1=YR(L)
      IF(L.NE.LR4) GO TO 210
      YC2=YR(L)
      XRC=YC2*TN1125
      XC2=XR(L)
      YRC=YC2
  210 RR=RR+RR
      SUMA=XR(1)*YR(1)*ACV
      AR(1)=SUMA
      DO 211 I=2,4
      AR(I)=XR(I)*YR(I)*ACV-SUMA
      ARI(I)=1.0/AR(I)
  211 SUMA=SUMA+AR(I)
      SUMA=0.19635
      DO 212 I=5,LR10
      AR(I)=XR(I)*YR(I)*ACV-SUMA
      ARI(I)=1.0/AR(I)
  212 SUMA=SUMA+AR(I)
      BY2=TN1125
      BY1=TAN(ACR*22.5)
      BI2=1.0/BY2
      BI1=1.0/BY1
      L=1
      DO 213 K0=1,351
      K=K0-1
      K1=K+1
      IF(K.GT.YR(L)*CRI) L=L+1
      YS(K1)=YR(L)
      IYN(K1)=L
  213 CONTINUE
      RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE SFCOB1 (NCARDX)
C
C          THIS SUBROUTINE READS IN THE FIRST SURFACE OBS CARD WHICH
C     CONSISTS OF THE 2400 OBS.--CONVERTS UNITS TO DEG., M/S
C
      COMMON/SFC/IWD(24),WS(24),ICLD(24),ITEMP(24)
      READ(NCARDX,5,END=10000)IHR,ICLD(24),ITEMP(24),IWD(24),WS(24)
10000 L=24
      IWD(L)=10.0*IWD(L)
      WS(L)=0.5154*WS(L)
      ITEMP(L) = (ITEMP(L)-32.)*0.5555 + 273.2
    5 FORMAT (BZ,8X,I2,2I5,5X,I5,F5.0 )
      RETURN
      END
      SUBROUTINE SFCOB2 (NCARDX)
C
C          THIS SUBROUTINE READS IN THE REST OF THE SURFACE OBSERVATIONS
C     FOR THE DAY AND CONVERTS UNITS
C
      COMMON/QUSTN1/YES,QPIN,QPGD1,QPGD2,QPGDT,QPFILE,QPOL(3),QAPRAC,QSE
     1C,QCAPR,QHRVOL,QFHWA,QSPD,ALT,CALIF,AREAID,QSTRT,QISMAP,QMIX
     2,NWIND,LCODE
      COMMON/SFC/IWD(24),WS(24),ICLD(24),ITEMP(24)
      DIMENSION IHR(24)
      DATA IHR/0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,2
     12,23/
      NTEMP = (ITEMP(24) -273.2)*1.8 + 32.1
      DO 100 L=1,23
      READ(NCARDX,5,END=  100)LHR,  ICLD(L),ITEMP(L),IWD(L),WS(L)
  100 CONTINUE
      IF(QPIN.EQ.YES)PRINT1,        (IHR(I),I=1,24),ICLD(24),(ICLD(I),I=
     11,23),  NTEMP  ,(ITEMP(I),I=1,23),IWD(24),(IWD(I),I=1,23),WS(24),(
     2WS(I),I=1,23)
C
C     CONVERTING UNITS TO DEGREES, M/S AND DEGREES KELVIN
C
      DO 150  L=1,23
      IWD(L)=10.0*IWD(L)
      WS(L)=0.5154*WS(L)
      ITEMP(L) = (ITEMP(L)-32.)*0.5555 + 273.2
  150 CONTINUE
    1 FORMAT(21H0 MET. DATA INPUTS--  /6H HOUR ,24I5/6H CLOUD,24I5/6H TE
     1MP.,24I5/6H DIR. ,24I5/6H SPEED,24F5.1)
    5 FORMAT (BZ,8X,I2,2I5,5X,I5,F5.0 )
      RETURN
      END
      SUBROUTINE MARIAH (NWIND,XWIND,YWIND,DIR,SPD,XX,YY,IHR,DIRM,SPDM)
C
C
C     THIS SUBROUTINE INTERPOLATES SPATIALLY AMONG NEARBY WIND
C     OBSERVATIONS TO OBTAIN THE WIND AT A GIVEN RECEPTOR LOCATION
C     ---LUDWIG AND SIMMON
C
      DIMENSION XWIND(100),YWIND(100),DIR(100,24),SPD(100,24)
C
C     IF ONLY ONE WIND OBSERVATION IS PROVIDED, THOSE VALUES ARE USED AT
C     THE RECEPTOR
      IF(NWIND.LE.1) GO TO 10
C
C     SET INITIAL DISTANCE LIMIT TO 10 KM (SQUARED)
      BIGD2=100.
      SUMWT=0.
      SUMU=0.
      SUMV=0.
 1      DO 100 IW=1,NWIND
C
C        CHECK FOR MISSING DATA--NEGATIVE SPEED
      IF (SPD(IW,IHR) .LT. 0.0) GO TO 100
C
C     FIND DISTANCE FROM WIND STATION TO RECEPTOR
        DX=XWIND(IW)-XX
        DY=YWIND(IW)-YY
        D2=DX*DX+DY*DY
C
C     COMPARE DISTANCE WITH LIMITS
        IF(D2.GT.BIGD2) GO TO 100
C
C     COMPUTE SUMS OF PRODUCTS OF APPROPRIATE WEIGHTING FACTORS
      IF (D2 .NE. 0.) GO TO 50
      SPDM = SPD (IW,IHR)
      DIRM = DIR (IW,IHR)
      GO TO 15
   50   DW=1./D2
      BEARIN=ATAN2(DY,DX)
      RADDIR=(270.-DIR(IW,IHR))/57.296
      WTFACT=(1.0-0.5*ABS(SIN(BEARIN-RADDIR)))*DW
        SUMU=SUMU+COS(RADDIR)*WTFACT*SPD(IW,IHR)
        SUMV=SUMV+SIN(RADDIR)*WTFACT*SPD(IW,IHR)
        SUMWT=SUMWT+WTFACT
 100    CONTINUE
C
C     IF THERE ARE NO OBSERVING STATIONS WITHIN 10 KM, RESET LIMIT TO
C     20 KM (SQUARED).  IF THERE ARE NO STATIONS WITHIN 20 KM, TAKE
C     VALUES OF FIRST OBSERVING STATION
      IF(SUMWT.NE.0.) GO TO 11
      IF(BIGD2.GE.400.) GO TO 10
      GO TO 1
C
C     SET WIND DIRECTION AND SPEED AT RECEPTOR TO THOSE VALUES OBSERVED
C     AT THE FIRST WIND STATION
 10   SPDM=SPD(1,IHR)
      DIRM=DIR(1,IHR)
      GO TO 20
C
C     COMPUTE WIND DIRECTION AND SPEED AT THE RECEPTOR
 11   U=SUMU/SUMWT
      V=SUMV/SUMWT
      SPDM=SQRT(U*U+V*V)
      DIRM=(4.7124-ATAN2(V,U))*57.296
      DIRM=AMOD(DIRM,360.)
   15 CONTINUE
 20   RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE STABLE(J,SAL,IJS)
C
C          THIS SUBROUTINE DETERMINES A STABILITY INDEX THROUGH A SERIES
C     OF CRITERIA  CONCERNING CLOUD COVER, WIND SPEED, AND SOLAR
C     ELEVATION(IJ=STABILITY INDEX, I=HOUR, SAL=SIN OF SOLAR ELEVATION)
C     ---LUDWIG AND MANCUSO
C
      DIMENSION IX(15),HCOS(24),IJS(24)
      COMMON/DEEPTH/ IHRSS
      COMMON/CSTAB/SP180,CP180
      COMMON/HMM/POP4,P(25),T(25),MAXT,MINT,HMAX,HMIN,NSL,SAP
      COMMON/MIX/ISTA,IYR,IMO,IDA,DAY,IDS,IHD,IST,IDATE,IDATE1,IDATE9
      COMMON /SFC/IWD(24),WS(24),ICLD(24),ITEMP(24)
      DATA HCOS /-0.9659,-0.866,-0.7071,-0.5,-0.2588,0.0,
     1   0.2588,0.5,0.7071,0.866,0.9659,1.0,0.9659,0.866,0.7071,0.5,
     2   0.2588,0.0,-0.2588,-0.5,-0.7071,-0.866,-0.9659,-1.0/
      DATA IX    /1,2,2,1,2,3,2,3,3,3,3,4,3,4,4/
      I=J
C
      CC=ICLD(I)*0.1
C
C     CONVERT M/S TO KNOTS
C
      WSP=WS(I)*1.94
       IJ=4
C
C          CALCULATION OF THE SIN OF THE SUNS ELEVATION ANGLE (SAL)
      XT=-0.43378*COS(0.0172142*(10.0+DAY))
       XS=XT/SQRT(1.0+XT*XT)
      XC=XS/XT
      XSP=XS*SP180
      XCP=XC*CP180
C
C     FINDING FIRST HOUR AFTER SUNSET(IHSS)
C
      DO 400JXZ=15,22
      SALPHA=XSP+HCOS(JXZ)*XCP
      IF(SALPHA.GE.0.0)GO TO 400
      IHRSS=JXZ
      GO TO 401
  400 CONTINUE
  401 I1=I-1
      IF (I1 .LT. 1) I1=24
C     SIN SOLAR ELEVATION PRECEDING HOUR
      SAP=XSP+HCOS(I1)*XCP
  102 HC=HCOS(I)
      SAL=XSP+HC*XCP
C
C          IS IT OVERCAST (CC GE 0.9)
      IF (CC.GE.0.9)GO TO 310
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C        IS IT NIGHT (SAL LESS 0)
      IF (SAL.LT.0.0)GO TO 305
C
C        CALCULATION OF DAYTIME STABILITY
C
C        IS THE SUN WITHIN 15 DEG OF HORIZON (SAL LESS 0.26)
      IF (SAL.LT.0.26)GO TO 310
C
C        RADIATION AND CLOUD AMOUNT EFFECT (XSOL=INSULATION)
      XSOL=(1.0-0.5*CC)*SAL
      IF (XSOL.GT.0.30)GO TO 120
      IRAD=3
      GO TO 200
  120 IF (XSOL.GT.0.55)GO TO 130
      IRAD=2
      GO TO 200
  130 IRAD=1
C
C        WIND SPEED EFFECT
  200 IF (WSP.GT.3.0)GO TO 210
      IWS=1
      GO TO 300
  210 IF (WSP.GT.6.0)GO TO 220
      IWS=2
      GO TO 300
  220 IF (WSP.GT.10.0)GO TO 230
      IWS=3
      GO TO 300
  230 IF (WSP.GT.12.0)GO TO 240
      IWS=4
      GO TO 300
  240 IWS=5
  300 IEX=(IWS-1)*3+IRAD
       IJ=IX(IEX)
      GO TO 310
C
C        CALCULATION OF NIGHTTIME STABILITY
  305 IF (WSP.GT.6.0)GO TO 310
      IF (CC.GE.0.5.AND.WSP.GT.3.0)GO TO 310
      IJ=5
  310 IJS(I)=IJ
      RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE CALCON(CCON)
C
C     THIS SUBROUTINE CALCULATES CONCENTRATIONS(CCON) AT A RECEPTOR
C     POINT USING PREVIOUSLY CALCULATED C/Q RATIOS(XOQ) AND EMISSIONS
C     (QOS) FOR EACH UP WIND SEGMENT --LUDWIG
C
      COMMON/QUSTN1/YES,QPIN,QPGD1,QPGD2,QPGDT,QPFILE,QPOL(3),QAPRAC,QSE
     1C,QCAPR,QHRVOL,QFHWA,QSPD,ALT,CALIF,AREAID,QSTRT,QISMAP,QMIX
     2,NWIND,LCODE
      COMMON/QUE/QL(10),Q(10),XOQ(10),SA,CA
C     SUMMING  TABULATIONS FROM EACH SEGMENT
C
      N1=1
C
C     STREET CANYON MODEL REPLACE FIRST SEGMENT
C
      IF(QSTRT.EQ.YES)N1=2
      CCON=0.0
      DO 120 J=N1,9
      CCON=CCON+XOQ(J)*Q(J)
  120 CONTINUE
      RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      FUNCTION NDAYWK(NDATE)
      INTEGER DAY
C     THIS ROUTINE RETURNS THE DAY OF THE WEEK FOR ANY DATE IN THE
C     TWENTIETH CENTURY BASED ON BINKOWSKI, BULL.AM.MET SOC., 55, PG.
C     600, 1976.
      DIMENSION MCUM(12)
      DATA MCUM/0,31,59,90,120,151,181,212,243,273,304,334/
      NYR=NDATE/10000
      MONTH=(NDATE-(NYR*10000))/100
      DAY=NDATE-10000*NYR-100*MONTH
      MO=MONTH
      LEAP=0
      NC=2
C     THE TWENTIETH CENTURY BEGAN ON A MONDAY.
      N4=NYR/4
      IF((NYR-4*N4).EQ.0)LEAP=1
      IF(NYR.EQ.0)LEAP=0
C     1900 WAS NOT A LEAP YEAR
      NDYS=MCUM(MONTH)+DAY
      IF(MO.GT.2)NDYS=NDYS+LEAP
C     THIS IS DAY NUMBER DURING THE YEAR
      NT=NC+NYR+N4
      N7=NT/7
      ND=NT-7*N7
      IF(ND.EQ.0)ND=7
      IF(LEAP.EQ.1)ND=ND-1
      IF(ND.EQ.0)ND=7
      NDAST=ND
C     THIS IS THE DAY ON WHICH THE YEAR STARTED
      NDK=NDAST+NDYS-1
      ND=NDK/7
      NK=NDK-ND*7
      IF(NK.EQ.0)NK=7
      NDAYWK=NK
      RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      FUNCTION NSEAS(IDAT)
      DIMENSION MOSE(12)
      DATA MOSE/1,1,2,2,2,3,3,3,4,4,4,1/
C
C     THIS ROUTINE RETURNS SEASON FROM DATE(YR-MO-DAY).  SEASON 1=DEC-
C     JAN-FEB, SEASON 2=MAR-APR-MAY ETC,
C
      NYR=IDAT/10000
      MONTH=(IDAT-(NYR*10000))/100
      NSEAS=MOSE(MONTH)
      RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE CALXOQ(HT,JI)
C
C           THIS SUBROUTINE CALCULATES THE X/Q VALUES FOR EACH OF THE
C     NINE SECTOR SEGMENTS USING THE GAUSSIAN AND BOX MODELS.
C     HT=MIXING HEIGHT, JI=STABILITY CLASS--LUDWIG AND MANCUSO
C
      DIMENSION R(10),A(9,6),B(9,6),AA(54),BB(54)
      COMMON /QUE/ QL(10), Q(10), XOQ(10), SA, CA
      EQUIVALENCE (A(1,1),AA(1)),(B(1,1),BB(1))
      DATA R /1.0,125.0,250.0,500.0,1000.0,2000.0,4000.0,8000.0,16000.0,
     132000.0/
C
C           VALUES USED FOR THE STABILITY PARAMETERS (A AND B).
      DATA AA /0.00,0.07,0.07,0.07,0.07,0.07,0.07,0.07,0.07,
     2                    0.00,0.12,0.12,0.12,0.12,0.12,0.12,0.12,0.12,
     3                    0.00,0.23,0.23,0.23,0.23,0.23,0.23,0.23,0.23,
     4                    0.00,0.50,0.50,0.50,0.50,0.50,0.50,0.50,0.50,
     5                    0.00,1.35,1.35,1.35,1.35,1.35,1.35,1.35,1.35,
     6                    0.00,3.00,3.00,3.00,3.00,3.00,3.00,3.00,3.00/
      DATA BB /0.00,1.28,1.28,1.28,1.28,1.28,1.28,1.28,1.28,
     2                    0.00,1.14,1.14,1.14,1.14,1.14,1.14,1.14,1.14,
     3                    0.00,0.97,0.97,0.97,0.97,0.97,0.97,0.97,0.97,
     4                    0.00,0.77,0.77,0.77,0.77,0.77,0.77,0.77,0.77,
     5                    0.00,0.51,0.51,0.51,0.51,0.51,0.51,0.51,0.51,
     6                    0.00,0.31,0.31,0.31,0.31,0.31,0.31,0.31,0.31/
      DO 140 I=1,9
      IP1=I+1
      BIJ=B(I,JI)
      AIJ=A(I,JI)
      IF(AIJ.EQ.0.) GO TO 20
      AI8=0.8/AIJ
   20 BIJ1=1.0-BIJ
      IF (I.GT.1)GO TO 25
      AIJ=A(2,JI)*R(2)**B(2,JI)
      AI8=0.8/AIJ
      GO TO 100
C
C     CALCULATING TRANSITION FROM GAUSSIAN TO BOX MODEL
C
   25 RT = (0.8*HT/AIJ)**(1.0/BIJ)
      IF (R(IP1)-RT)100,100,115
  100 IF (BIJ1)110,105,110
C
C     GAUSSIAN FOR EXPONENT=0
C
  105 XOQ(I)=AI8*ALOG(R(IP1)/R(I))
      GO TO 140
C
C     GAUSSIAN
C
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      GO TO 140
 115  IF (R(I)-RT)125,125,120
C
C     BOX
C
  120 XOQ(I)=(R(IP1)-R(I))/HT
      GO TO 140
 125  IF (BIJ1)135,130,135
C
C     MIXED BOX AND GAUSSIAN FOR EXPONENT=0
C
  130 XOQ(I)=AI8*ALOG(RT/R(I))+(R(IP1)-RT)/HT
      GO TO 140
C
C     MIXED BOX AND GAUSSIAN
C
  135 XOQ(I)=AI8*(RT**BIJ1-R(I)**BIJ1)/BIJ1+(R(IP1)-RT)/HT
 140  CONTINUE
      RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE STREET(WS, WD, STDIR, QST, X, Z, H, W, CHI)
C
C       CALCULATES STREET CANYON CONTRIBUTION TO CONCENTRATION (UG/M3)
C       --LUDWIG
C
C       QST=EMISSION RATE (UG/M*S)
C       WD=WIND DIRECTION (DEG CW FROM N)
C       WS=WIND SPEED (M/S)
C       STDIR=STREET DIRECTION--RECEPTOR TO RIGHT WHEN FACING THIS DIR.
C       W,H=WIDTH AND HEIGHT OF STREET CANYON (M)
C       Z,X=HEIGHT AND HORIZONTAL DISTANCE FROM TRAFFIC TO RECEPTOR (M)
C      COS60=COS(60 DEGREES)
      DATA COS60 /0.5/
      CHI = 0.0
C
C       NO CONTRIBUTION FROM STREET IF RECEPTOR ABOVE TOP OF ST. CANYON
C
      IF (H-Z) 86,86,120
C
C       ANGLE NORMAL TO STREET DIRECTION
C
  120 ANGLE = STDIR + 90.0
C
C       COS OF DIFFERENCE BETWEEN WIND AND STREET DIRECTIONS
C
      COSDIF = COS((WD - ANGLE)*0.0174533)
C
C       CWIND (CLEE)= CONCENTRATION AT RECEPTOR FACING TOWARD (AWAY FROM)
C       THE WIND
C
      CWIND = 7.0*QST*(H -Z)/((WS + 0.5)*W*H)
      CLEE = 7.0*QST/((WS + 0.5)*(SQRT(X*X + Z*Z) + 2.0))
C
C       TEST TO DETERMINE WHETHER WIND IS BLOWING WITHIN 30 DEG OF
C       PARALLEL TO ST, OR TOWARD, OR AWAY FROM RECEPTOR
C
      IF (COSDIF .GT. 0.0) GO TO 125
      IF(ABS(COSDIF) .LE. COS60) GO TO 130
      CHI = CWIND
      GO TO 86
  125 IF(ABS(COSDIF) .LE. COS60) GO TO 130
      CHI = CLEE
      GO TO 86
  130 CHI = (CLEE + CWIND)*0.5
   86 CONTINUE
      RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE RETRAF(ITFYL,NCARDI,KHR1,LASTHR)
C
C     THIS ROUTINE READS INTERSECTION TRAFFIC VOLUMES, ETC. AND WRITES
C     TEMPORARY FILE FOR USE BY INTERSECTION MODEL.
C
      DIMENSION VOL(4,3),PFRAC(4),PH(4),RELART(4),NAL(4),GCAP(4)
      COMMON/DIMINT/ZCONST,HEIGHT(8),NLANE(8),XII1(4),YII1(4),XII2(4),YI
     1I2(4)
      COMMON/QUSTN1/YES,QPIN,QPGD1,QPGD2,QPGDT,QPFILE,QPOL(3),QAPRAC,QSE
     1C,QCAPR,QHRVOL,QFHWA,QSPD,ALT,CALIF,AREAID,QSTRT,QISMAP,QMIX
     2,NWIND,LCODE
      REWIND ITFYL
      DO 100 I=KHR1,LASTHR
      READ(NCARDI,6001,END=10000)IFLAG,((VOL(J,K),K=1,3),J=1,4),(PFRAC(L
     +),L=1,4)
10000 READ(NCARDI,6092,END=10001)ITYPC,ICYCL,PH,CI,GCAP,RELART,NAL
10001 IF(QPIN.EQ.  YES) PRINT 7001,IFLAG,((VOL(J,K),K=1,3),J=1,4),(PFRAC
     1(L),L=1,4),ITYPC,ICYCL,PH,CI,GCAP,RELART,NAL
      WRITE(ITFYL,6091)IFLAG,((VOL(J,K),K=1,3),J=1,4)
      WRITE(ITFYL,6192)ITYPC,ICYCL,PH,CI,GCAP,RELART,NAL
      WRITE(ITFYL,6093)(XII1(J),YII1(J),XII2(J),YII2(J),J =1,4)
      WRITE(ITFYL,6094)ZCONST,HEIGHT,NLANE,PFRAC
  100 CONTINUE
      REWIND ITFYL
 6001 FORMAT(BZ,I5,12F5.0,4F3.3)
 6091 FORMAT(I5,12F6.0)
 6092 FORMAT(BZ,I2,I4,13F4.0,4I4)
 6192 FORMAT(I2,I4,13F5.0,4I4)
 6093 FORMAT(16F7.0)
 6094 FORMAT(9F4.0,8I3,4F3.2)
 7001 FORMAT(25H0   INTERSECTION INPUTS-- /5X,I5,12F5.0,4F4.3/5X,I2,I4,1
     13F6.0,4I4)
      RETURN
      END
      SUBROUTINE INT
C***********************************************************************
C
C     THIS PROGRAM CONTROLS THE CALLING OF THE SUBROUTINES OF THE
C     INTERSECTION MODEL--SIMMON.
C
      COMMON/CLINE/IJLOC(8),IJSPD(8)
      COMMON /TRAF/ DLINK(8,5), NLINK, Q(8,5,2), HEIGHT(8), NLANE(8)
     1,ZCONST
      COMMON /XY/ X1(8), X2(8), Y1(8), Y2(8)
      COMMON/RECEP/XO,YO
      COMMON /OVRLAY/ XR(625),YR(625),ISTABL(24),LDIR(625),
     1LSPD(625),KHR1,LASTHR,NRECP,KPOL,CRUD,NDATE,MSTA(3),NNHR,HT,JI,
     2HMIX(25),IDOFRC(625),CON(625)
      COMMON/QUSTN1/YES,QPIN,QPDG1,QPDG2,QPGDT,QPFILE,QPOL(3),QAPRAC,QSE
     1C,QCAPR,QHRVOL,QFHWA,QSPD,ALT,CALIF,AREAID,QSTRT,QTSMAP,QMIX
     2,NWIND,LCODE
      DIMENSION CHISM(2)
C
      ITFYL = 14
      DO 20 IHR=KHR1,LASTHR
      CALL INPTMI(ITFYL)
      JJ1=IHR-KHR1+1
      THETA = LDIR(JJ1)
      WS = LSPD(JJ1)
      ISTAB = ISTABL(IHR)
      XO = XR(1)*1000.
      YO = YR(1)*1000.
      CALL INSEC
      CALL EMITX(QPOL,LCODE,IJSPD)
      CALL LINE(THETA,WS,ISTAB,X1,X2,Y1,Y2,CHISM)
C
C     CONVERT HC TO 10-MICROGM/MS AND CO TO 100-UG/M3 UNITS
C
      IF(KPOL.EQ.1) C = CHISM(KPOL)*1.0E5
      IF(KPOL.EQ.2) C = CHISM(KPOL)*1.0E4
   20 CON(JJ1) = CON(JJ1)+C
C     RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE INPTMI(ITFYL)
C
C     READS INPUT DATA FOR INTERSECT. AND LN. SRC. MODELS--SANDYS/SIMMON
C
      COMMON /INSECT/ITYPC,ICYCL,IFLAG,CI,TP,W1,NS,VOL(4,3),PH(4),GCAP(4
     1),RELART(4),NAL(4),DELA(4,3),DELAI(8),QQ(4,3),PT(4,3),Y(4,3),CAP(4
     2,3),YT(4),QUEUE(4),COUNT(4,4)   ,NSTOPS(4),PFRAC(4)
      COMMON /TRAF/ DLINK(8,5), NLINK, Q(8,5,2), HEIGHT(8), NLANE(8)
     1,ZCONST
      COMMON /XY/ X1(8), X2(8), Y1(8), Y2(8)
C     ASSIGN A CONSTANT TIME PERIOD OF ONE HOUR TO ALL VOLUME FIGURES
      TP = 3600.
      READ(ITFYL,91,END=10000)IFLAG,((VOL(J,K),K=1,3),J=1,4)
 91   FORMAT (BZ,I5, 12F6.0)
10000 IF ( IFLAG .EQ.1) GO TO 11
      IF (IFLAG .EQ. 2) GO TO 15
 11    DO 12 J = 1,4
       DO 12 K = 1,3
  12  COUNT(K,J)    = VOL(J,K)
      GO TO 2
 15    DO 17 J = 1,4
       DO 16 K= 2,3
  16  COUNT(K,J)    = VOL(J,1) * VOL(J,K)
  17  COUNT(1,J)    = VOL(J,1) - COUNT(2,J)    - COUNT(3,J)
    2 READ(ITFYL,92,END=10001)ITYPC,ICYCL,PH,CI,GCAP,RELART,NAL
 92   FORMAT ( BZ,I2, I4, 13F5.0, 4I4 )
10001 CYCL = ICYCL
      DO   22 J =1,4
      IT = RELART(J)/ CYCL
      IF ( RELART(J) .GT. CYCL .OR. RELART(J) .LT. -CYCL)
     1 RELART(J) = RELART(J) - IT*ICYCL
 22   CONTINUE
C     READ X,Y COORDINATES OF LINKS IN .01 MILES
    3 READ(ITFYL,93,END=10002)(X1(J),Y1(J),X2(J),Y2(J),J=1,4)
 93   FORMAT  ( BZ,16F7.0)
10002 DO   35 J = 1,4
      X1(J+4) = X2(J)
      X2(J+4) = X1(J)
      Y1(J+4) = Y2(J)
 35   Y2(J+4) = Y1(J)
C  READ THE HEIGHT ABOVE THE RECEPTOR, LINK LANES, AND FRACTION OF ARRIVALS
C  THAT ARE PART OF PLATOON, AND INITIAL DISPERSION Z
    4 READ(ITFYL,94,END=10003)ZCONST,HEIGHT,NLANE,PFRAC
 94   FORMAT  (BZ,9F4.0, 8I3, 4F3.2)
10003 RETURN
      END
      SUBROUTINE INSEC
C  THIS PROGRAM COMPUTES DELAY AND QUEUE LENGTH AT AN INTERSECTION.
C  IT IS BASED ON WEBSTERS      INTERSECTION MODEL.  THREE TYPES OF
C  SIGNALS MAY BE SPECIFIED 1)FIXED TIME 2)ACTUATED WITH LEFT THURN
C  PHASES 3)ACTUATED WITH SEPERATE PHASES FOR EACH APPROACH.  THIS MODEL
C  WILL HANDLE OVER CAPACITY INTERSECTIONS, AN EXTENSION TO WEBSTERS
C  MODEL, BY ASSUMING CAPACITY FLOW WHEN THE QUEUE LENGTH AT THE END
C  OF GREEN EQUALS HALF THE ARRIVALS ON RED PLUS THE ARRIVALS ON GREEN
C  CYCLE AND PHASE
C  LENGTHS ARE COMPUTED BASED ON F.V.WEBSTER 'TRAFFIC SIGNAL SETTINGS'
C         ----SANDYS
C
      COMMON /INSECT/ITYPC,ICYCL,IFLAG,CI,TP,W1,NS,VOL(4,3),PH(4),GCAP(4
     1),RELART(4),NAL(4),DELA(4,3),DELAI(8),QQ(4,3),PT(4,3),Y(4,3),CAP(4
     2,3),YT(4),QUEUE(4),COUNT(4,4)   ,NSTOPS(4),PFRAC(4)
      COMMON /TRAF/ DLINK(8,5), NLINK, Q(8,5,2), HEIGHT(8), NLANE(8)
     1,ZCONST
      COMMON /XY/ X1(8), X2(8), Y1(8), Y2(8)
      REAL MINR
      DIMENSION NPHASE(18)
      DATA NPHASE/4HNOR-,4HAPPR,4HEAS-,4HAPPR,4HSOU-,4HAPPR,4HWES-,4HAPP
     1R,4HN-AP,4HP-LE,4HS-AP,4HP-LE,4HE-AP,4HP-LE,4HW-AP,4HP-LE,4H    ,4
     2H    /
C
C  FOR EACH SIGNAL PHASE DETERMINE A PHASE LENTH
C
 1    NP = 0
      MINR = 1.0
      SY = 0
C   INITIALIZE VOLUMES ON EACH APPROACH
      DO 15 J=1,4
      VOL(J,1)=0.0
      VOL(J,1)=COUNT(3,J)   + COUNT(2,J)   + COUNT(1,J)
      VOL(J,2) = 0.0
      VOL(J,3) = 0.0
      CAP(J,2)=0.
      CAP(J,3)=0.
      DELAI(J)=0.
      DELAI(J+4)=0.
      QQ(J,1) =0.
      QQ(J,2)=0.
      QQ(J,3)=0.
 15   CONTINUE
      IF(ITYPC .EQ. 0) GO TO  7
C  FIRST DETERMINE THE VOLUME AND CAPACITY OF EACH APPROACH.
 2    J1 = 1
C   J IS INDEX OF APPROACH DIRECTION
C  J2 IS INEEX OF PHASE CONTROLLING THIS APPROACH
      DO 25 J = 1,4
      CAP(J,1)=0.5
```

```
C  SUB-PHASE CONTROLING THE N-S OR E-W APPROACHES
      J2 = J1
C   SET INDEX J3 TO IDENTIFY OPPOSING TRAFFIC
C     IE OPPOSING APPROACH
      J3 = J1
      IF(J .LE. 2) J3 = J+2
      IF(ITYPC    .EQ. 3) GO TO 21
      IF(ITYPC    .EQ. 4 .AND. J1 .EQ. 2) GO TO 21
      IF(ITYPC    .EQ. 5 .AND. J1 .EQ. 1) GO TO 21
      CAP (J,1) = GCAP(  J2)
      IF (CAP(J,1) .EQ. 0.0) CAP(J,1) = NAL(J)*1200.
      IF (VOL(J,1) .LE. 0.) GO TO 24
C  CONTROL IS BY A TWO PHASE SIGNAL WITH 2 POSSIBLE MINOR MOVEMENTS
       IF ( PH(J2 +2) .NE. 0.) GO TO 22
      IF (VOL(J3,1) .EQ. 0.0) GO TO 225
C  MODIFY THE CAPACITIES DUE TO LEFT TURNING VEHICLES (SEE TABLE6.5 HCM)
  200 PCNTUR = AMIN1(COUNT(3,J ) /VOL(J,1) ,0.3)
      BASEPT = 0.1
      DIF = 0.5
      BPVAL = 0.0
       IF (NAL(J) .GT. 2) GO TO 208
       IF (NAL(J) .EQ. 2) GO TO 205
      IF(PCNTUR   .LT. 0.2) GO TO 201
      BASEPT = 0.2
      BPVAL = 0.15
      GO TO 208
 201   IF(PCNTUR  .LT. 0.15) GO TO 203
      BASEPT = 0.15
      BPVAL = 0.1
      GO TO 207
 203  DIF = 2.0
      IF(PCNTUR  .LT. 0.1) DIF = 3.0
      GO TO 208
 205   IF(PCNTUR  .LT. 0.2) GO TO 207
      BASEPT = 0.2
      BPVAL = 0.1
      GO TO 208
 207  DIF = 1.0
 208  FACL = DIF*(BASEPT -PCNTUR )-BPVAL
      GO TO 23
C  CAPACITY IS IDENTICAL FOR ALL THREE TURNING MOVEMENTS OF APPROACH
 21   J2 = J
       CAP( J,1) = GCAP( J2)
       IF( CAP(J,1) .EQ. 0.0)  CAP(J,1)= NAL(J)*1200.
      IF (VOL(J,1) .LE. 0.0) GO TO 24
      GO TO 225
   22 VOL(J,1) = COUNT(2,J)   + COUNT(1,J)
      VOL(J,3) = COUNT(3,J)
C
C  ASSUME A LEFT TURN CHANNEL THAT STORES ALL THE LEFT TURNING
```

```
        CAP(J,1) = CAP(J,1) *(1.0 +0.3/NAL(J))
        CAP(J,3) = GCAP(J1 +2)
       IF(CAP(J,3) .LE. 0.) CAP(J,3) = 1200.
       Y(J,3) = VOL(J,3)/ CAP(J,3)
  225   FACL = 0.3/ NAL(J)
C  MODIFY THE CAPACITIES DUE TO VARIATIONS IN RIGHT TURNING VEHICLES
  23   FACR = 2.0
       IF (VOL(J,1) .LE. 0.0) GO TO 24
       PCNTUR = AMIN1(COUNT(2,J ) /VOL(J,1) ,0.3)
       IF(PCNTUR  .GT. 0.1) FACR = 1.0
        IF( NAL(J) .EQ. 2) FACR = 0.5
        IF( NAL(J) .GT. 2) FACR = 0.25
       FACR = (0.1-PCNTUR )*FACR
        IF(NAL(J) .EQ.1 .AND. PCNTUR .GT. 0.2) FACR =FACR-(PCNTUR
      1-0.2)/2.0
       CAP(J,1) = CAP(J,1) * (1.0+FACR + FACL)
C  COMPUTE WEBSTERS HIGHEST RATIO OF FLOW TO SATURATION FLOW FOR EACH
C  PHASE
    24 Y(J,1) = 0.0
       IF (CAP(J,1) .GT.0.0) Y(J,1) = VOL(J,1)/CAP(J,1)
  25   J1 = 3-J1
C
C  CALCULATE THE MAXIMUM Y FOR EACH PHASE
       YT(3) = Y(3,1)
       YT(1) = Y(1,1)
       IF(ITYPC    .EQ. 3 .OR. ITYPC    .EQ. 5) GO TO 26
       YT(1)= AMAX1 (Y(1,1), Y(3,1))
       YT(3) = 0.0
        IF( PH(3) .NE. 0.) YT(3) = AMAX1( Y(3,3),  Y(1,3))
    26 YT(4) = Y(4,1)
       YT(2) = Y(2,1)
        IF( ITYPC .EQ.3 .OR. ITYPC .EQ.4 ) GO TO 27
       YT(2) = AMAX1 (Y(2,1) , Y(4,1))
       YT(4) = 0.0
        IF( PH(4) .NE. 0.0) YT(4) = AMAX1( Y(2,3), Y(4,3))
  27   DO 28 J=1,4
    28 PT(J,1) = PH(J)
        COT = ICYCL
        IF( ITYPC .EQ. 1) GO TO 40
C  CALCULATE THE CONTROLING  Y RATIO TO PHASE TIME RATIO
       DO 29 J =1,4
        IF( PH(J) .EQ. 0.) GO TO 29
       IF(YT(J) .LE. 0.0) GO TO 29
       SY = YT(J) + SY
        MINR = AMIN1(MINR, YT(J)/PH(J))
       NP= NP + 1
  29   CONTINUE
C  CALCULATE A CYCLE TIME CO
       CO = 0.0
       DO 31 J = 1,4
```

```
 31    CO = CO + YT(J)/MINR
C  CALCULATE WEBSTERS OPTIMUM CYCLE TIME
        COT = ICYCL
        IF(SY .LT.1.0 ) COT =(1.5*(CI/2.0 +3.0)*NP +5.0)/(1.0- SY)
       IF (CO .GT. COT) GO TO34
        IF(CO .GT. ICYCL ) GO TO 33
        IF(COT .GT. ICYCL) GO TO 33
       GO TO 343
 33     CO = ICYCL
       GO TO 35
 34     IF( COT .GT. ICYCL) GO TO 33
 343   CO = COT
 35    COT = CO
       SPT = 0.0
       SPH = 0.0
C   FIND THE PHASE TIMES FOR THIS CYCLE LENGTH
       DO 37 J=1,4
        IF(PH( J) .LE. 0.0) GO TO 37
       PT(J,1) = YT(J) / SY*COT
       IF ( PT(J,1) .GT. PH(J)) GO TO 36
C  PHASE SKIPPABILITY IS ASSUMED FOR CONTROLLER.
       IF(PT(J,1) .LE. 0.0) GO TO 37
        SPH = SPH + PH(J)
       PT(J,1) = PH(J)
       GO TO 37
   36 SPT = PT(J,1) + SPT
 37    CONTINUE
       IF(SPT + SPH .LE. COT) GO TO 40
       COT = SPT + SPH
        IF(COT .LE. ICYCL) GO TO 40
C  REDISTRIBUTE TIME BEYOND PHASE TIME.
        RDIS = COT- ICYCL
        COT  = ICYCL
       DO 39 J=1,4
C  PHASE MIGHT BE 0.0 , EQUAL OR GREATER THAN PH(I,J)
       IF (PT(J,1) .LE. PH(J)) GO TO 39
       PTJ = PT(J,1)
       PT(J,1) = PT(J,1) *(1.0 - RDIS/SPT)
       IF (PT(J,1) .LT. PH(J)) PT(J,1) = PH(J)
       SPT = SPT - PTJ
       RDIS = RDIS - PTJ + PT(J,1)
 39    CONTINUE
C
C  COMPUTE DELAY , QUEUE LENGTH, NSTOPS
C   SET J1, A PHASE INSEX, J1 = 1,2,1,2 WHEN J= 1,2,3,4 AND ITYPC = 1 ,2
 40    J1 = 1
       DO 63 J=1,4
       NS = 0
       W1 = 0.0
       W2 = 0.0
```

```
      DO 61 K=1,3
      IF(K .EQ. 2) GO TO 60
C  DETERMINE THE PHASE INDEX J2 OF THIS APPROACH AND TURNING MOVEMENT.
       IF( ITYPC .LT. 3 ) GO TO 43
       IF( ITYPC .EQ. 4 .AND. J1.EQ. 1) GO TO 43
       IF( ITYPC .EQ. 5 .AND. J1.EQ. 2) GO TO 43
      IF(K .EQ. 3) GO TO 60
      J2 = J
      GO TO 44
 43   J2 = J1 + K-1
   44 IF (PT(J2,1) .EQ. 0.0 .AND. K .EQ.3) GO TO 60
C   IF SIGNALS ARE FIXED TIME AND COORDINATED CALL SUBROUTINE PLATOON
       IF( RELART(J) .NE. 0.0 .AND. K.EQ.1) CALL PLATON  (J,J2)
C  MODIFY CAPACITY PER HOUR OF GREEN TO CAPACITY PER HOUR
      CAP(J,K) = CAP(J,K) * (PT(J2,1) -CI/2.0)/COT
      CAP(J,K) = AMAX1(0.0, CAP(J,K))
C  TEST THAT THE VOLUME DOES NOT EQUAL CAPACITY, CAPACITY IS DEVALUED
      GREENQ = 0.0
      IF(PT(J2,1) .GT. 0.0) GREENQ = 3600./(COT + PT(J2,1))
      IF(VOL(J,K) + GREENQ      .GE.      CAP(J,K)) GO TO 50
C  COMPUTE QUE LENGTH AT END OF GREEN
       IF (RELART(J) .NE. 0.0 .AND. K.EQ.1 ) GO TO 46
      W1 = (COT - PT(J2,1) )**2/(2.0*COT*(1.0-Y(J,K)))
 46   QO = VOL(J,K)/(2.0*(CAP(J,K) - VOL(J,K)))
      IF(K .GT. 1) GO TO 54
      GO TO 52
 50   IF(GREENQ .GT. 1.0)
     1 QO =  CAP(J,K)*(GREENQ*2.0 - 1.0 + AMIN1(VOL(J,K)-CAP(J,K),0.0))
     2 /(2.0*GREENQ*(GREENQ-1.0))- 0.5
      W1 = (COT- PT(J2,1))/2.0
      IF(VOL(J,K).GT.CAP(J,K))
     1Q1 = AMAX1 (0.0, (VOL(J,K)- CAP(J,K))*TP/3600. )
      IF(K .GT. 1) Q1 = AMAX1(0.0,(VOL(J,K)-CAP(J,K))*TP/3600.)
      IF(Q1 .GT. 0.0) W3 = TP
      IF(CAP(J,K) .GT. 0.0) W3 = Q1*1800./CAP(J,K)
 52   QO = QO + Q1
 54   W2 = QO*1800.
      IF(CAP(J,K) .NE. 0.) W2 = QO*3600./CAP(J,K)
       IF (RELART(J) .NE. 0.0 .AND. K.EQ.1)  GO TO 60
      NS= (1.0-PT(J2,1)/COT)/(1.0-Y(J,K))*VOL(J,K)*TP/3600.+NS
 60    DELA(J, K) = W1 + W2
      QQ(J,K) = QO
      IF (K.GT. 1) GO TO 61
C  COMPUTE THE MAXIMUM  QUEUE EXTENSION FOR A SIGNAL CYCLE.
C  QUEUE AT END OF GREEN + NUMBER OF STOPS PER CYCLE
      QUEUE(J) = QO + NS*COT/TP
      QO = 0.0
 61   CONTINUE
       QUEUE(J) =  QUEUE(J) + QO
       NSTOPS(J) = NS
      QQ(J,2) = QQ(J,3)
      VOL(J,2) = VOL(J,3)
      CAP(J,2) = CAP(J,3)
      Y(J,2) = Y(J,3)
       DELAI (J) = DELA(J,1)
       DELAI (J+4)=DELA(J,3)
63    J1 = 3-J1
      GO TO 73
7     DO 71 J=1,4
      DO 70 K=1,3
 70   DELA(J,K) = PH(J)
      QUEUE(J) = GCAP(J)
       NSTOPS(J) = QUEUE(J) * ICYCL
71    DELAI(J) = PH(J)
73    CONTINUE
      Y(1,3)=0.0
      CAP(1,3)=0.0
      VOL(1,3)=0.0
      QQ(1,3)=0.0
      PRINT 9631, (J,J=1,4)
9631  FORMAT(34H0INTERSECTION SIMULATION OUTPUTS-- /4(23X,5HPHASE ,I2))
      PRINT 9632, (PT(J,1),J=1,4)
9632  FORMAT (5H TIME, 4(18X,F4.0,8X))
      PRINT 9633, (YT(J),J=1,4)
9633   FORMAT (5H V/GC, 4(18X,F7.5,5X))
       IF (ITYPC .GT. 2) GO TO 6331
      I2=3
      I4=4
      I5=5
      I6=6
      I7=7
      I8=8
      I9 = 7
      I10 = 6
      GO TO 6335
6331   IF (ITYPC .GT. 3) GO TO 6332
      I2= 9
      I4=9
      I6=9
      I8=9
      I5=3
      I7=4
      I9=9
      I10=4
      GO TO 6335
6332   IF (ITYPC .GT. 4) GO TO 6333
      I2=3
      I4=9
      I8=9
      I5=5
      I7=4
      I9=7
      I10=4
      GO TO 6335
 6333 CONTINUE
      I2=9
      I6=9
      I4=4
      I5=3
      I7=7
      I8=8
      I9=9
      I10=6
 6335 K2 = 2*I2-1
      K21=K2+1
      K5 = 2*I5-1
      K51 = K5+1
      K6 = 2* I6-1
      K61 = K6 +1
      K4 = 2*I4 -1
      K41 = K4+1
      K7 = 2* I7-1
      K71 = K7+1
      K8 = 2* I8-1
      K81 = K8+1
      PRINT 96335,NPHASE(1),NPHASE(2),NPHASE(K2),NPHASE(K21),NPHASE(3),N
     1PHASE(4),NPHASE(K4),NPHASE(K41),NPHASE(K5),NPHASE(K51),NPHASE(K6),
     2NPHASE(K61),NPHASE(K7),NPHASE(K71),NPHASE(K8),NPHASE(K81)
96335 FORMAT(5X,4(5X,2A4,3X,2A4,6X))
       PRINT 9634, (DELAI(J), DELAI(J+2),J=1,2), DELAI(I5),DELAI(I9),
     1 DELAI (I10), DELAI( I8)
 9634 FORMAT (5H DELA, 4(5X,2F10.0,5X))
      PRINT 9635,(QUEUE(J),QUEUE(J+2),J=1,2),QO(I5,1),QO(I9,1),QO(I10,1)
     1,QO(I8,1)
 9635 FORMAT (6H QUEUE ,4(4X,2F10.0,6X))
      PRINT 9636, (VOL(J,1),VOL(J+2,1),J=1,2),VOL(I5,1),VOL(I9,1),VOL(I1
     10,1),VOL(I8,1)
 9636 FORMAT (7H VOLUME ,4(3X,2F10.0,7X))
      PRINT 9637, (CAP(J,1),CAP(J+2,1),J=1,2),CAP(I5,1),CAP(I9,1),CAP(I1
     10,1),CAP(I8,1)
 9637 FORMAT (9H CAPACITY ,4(1X,2F10.0,9X))
      PRINT 9638,(Y(J,1),Y(J+2,1),J=1,2),Y(I5,1),Y(I9,1),Y(I10,1),Y(I8,1
     1)
 9638 FORMAT (7H V/GCAP ,4(3X,2F10.5,7X))
      GO TO 90
 90   CONTINUE
      RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE PLATON (J,J2)
C  THIS ROUTINE ASSUMES THAT AN INTERSECTION UPSTREAM OF THIS ONE,BEHAVES IN
C  EXACTLY THE SAME WAY, THE ONLY DIFFERENCE BEING THEIR RELATIVE ARRIVAL
C  TIMES (RELART)--SANDYS
      COMMON /INSECT/ITYPC,ICYCL,IFLAG,CI,TP,W1,NS,VOL(4,3),PH(4),GCAP(4
     1),RELART(4),NAL(4),DELA(4,3),DELAI(8),QQ(4,3),PT(4,3),Y(4,3),CAP(4
     2,3),YT(4),QUEUE(4),COUNT(4,4)   ,NSTOPS(4),PFRAC(4)
      COMMON /TRAF/ DLINK(8,5), NLINK, Q(8,5,2), HEIGHT(8), NLANE(8)
     1,ZCONST
      COMMON /XY/ X1(8), X2(8), Y1(8), Y2(8)
      NS = 0.0
      W1= 0.
      IF ( PT(J2,1)* CAP(J,1)/TP .LT. (COUNT(1,J)+COUNT(2,J)+COUNT(3,J))
     1 /TP *ICYCL) GO TO 80
      IF (COUNT(1,J) + COUNT(2,J) + COUNT(3,J) .EQ. 0.0) GO TO 90
      IF ( PFRAC(J) .NE. 0.0) GO TO 102
C  DETERMINE A THEORETICAL FLOW RATE FOR THE PLATOON OF ARRIVALS (VEH/SEC)
        Q2 =   COUNT(1,J)/( COUNT(2,J) +COUNT(3,J) + COUNT(1,J))
     1 *  CAP( J,1)/ TP
      GO TO 104
 102  Q2 = PFRAC(J) * CAP(J,1)/TP
 104  T2 = PT(J2,1)
      IF ( Q2 .NE. 0.0) T2 = COUNT(1,J) * ICYCL/ (TP * Q2)
C  THE REMAINING VEHICLES ARRIVE AT RATE Q1
        Q1 =( COUNT(2,J) + COUNT(3,J))/(TP *(1.0 - T2/ ICYCL))
C  SS IS SATURATION FLOW
        SS = CAP(J,1)/TP
C  CONSIDER TWO CASES,THE FIRST WHERE RELART PLUS T2 IS GREATER THAN  OR
C  EQUAL TO THE GREEN PHASE TIME.
        R = ICYCL - PT(J2,1)
      IF(RELART(J) .LT.-R) RELART(J) = RELART(J) + ICYCL
      IF (RELART(J) .GT. PT(J2,1)) RELART(J) = RELART(J) - ICYCL
C  TEST IF THE PLATOON ENDS IN GREEN OR RED
      IF(RELART(J) + T2 .LT. 0.0) GO TO 4
      IF (PT(J2,1) .LT. T2 + RELART(J))GO TO 2
C  FIND THE TOTAL DELAY DURING RED, DR, AND QUEUE LENGTH AT END RED, QR
 1    IF ( RELART(J).LE.0.)GO TO 110
      QR = Q1* R
      DR =  QR * R/ 2.0
      GO TO 13
 110  QR = Q1* (R + RELART(J)) - Q2*RELART(J)
      DR =(Q1 *( R - RELART(J)    )*(R + RELART(J)) + Q2*(RELART(J))**2)
     1 /2.0
C  FIND THE TOTAL DELAY DURING THE GREEN PHASE,GR
C
C     FIRST FIND THE GREEN TIME REQUIRED TO EXHAUST THE QUEUE, GP
C
 13   IF (RELART(J) .LE. 0) GO TO 14
 131  GP =  QR /(SS -Q1)
      IF ( GP .GE. RELART(J))GO TO 133
      GO TO 85
 133  GP =(QR + RELART(J)*(Q1-Q2))/(SS-Q2)
      IF (GP .LE. RELART(J) +T2) GO TO 135
      GP =(QR + T2*(Q2-Q1))/(SS-Q1)
      GR =GP*(QR +Q1*RELART(J) + T2*Q2) - T2*T2* Q2*(.5 +RELART(J))
     1 - Q1* RELART(J) **2/2.0 + Q1*(GP-T2 -RELART(J))**2/2.0 - SS*GP*GP
     2 /2.0
      GO TO 85
 135  GR = Q2*( GP -RELART(J))**2 /2.0 + QR*GP + GP*Q1*RELART(J)
     1  - Q1*RELART(J)**2/2.0  - SS*GP*GP/2.0
      GO TO 85
 14   GP = QR /(SS - Q2)
      IF  (GP .LE. T2 + RELART(J) ) GO TO 15
      GP =(QR +(T2 + RELART(J))*(Q2-Q1)) /(SS-Q1)
      GR =  QR*GP + Q2*(T2+RELART(J))*(GP- (T2 +RELART(J))/2.0)
     1 + Q1* (GP - T2 -RELART(J))**2 /2.0 - SS*GP*GP/2.0
      GO TO 85
 15   GR = GP *( QR  +    GP/2.0*(Q2 - SS))
      GO TO 85
C  THE SECOND CASE IS WHERE RELART + T2 IS LESS THAN THE GREEN PHASE
 2    IF (RELART(J) .LE. 0.) GO TO  5
      QR=Q2*(T2+RELART(J)-PT(J2,1))+Q1*(R-(T2+RELART(J)-PT(J2,1)))
      DR=Q2*(T2+RELART(J)- PT(J2,1))*(R- (T2+ RELART(J)-PT(J2,1))/2.0)
     1+  Q1*(R- T2 -RELART(J)+ PT(J2,1))**2/2.0
      GO TO 131
 4    QR=Q1 *(R-T2)+ Q2*T2
      DR=Q1*((R+ RELART(J))*( R-RELART(J))+(RELART(J)+T2)**2)/2.0
     1 -Q2*T2*(RELART(J)+T2/2.0)
      GP=QR/(SS-Q1)
      GR=QR*GP/2.0
      GO TO 85
 5    QR=Q2* (T2-PT(J2,1))+  Q1* (ICYCL -T2)
      DR=Q2* (T2+RELART(J)-PT(J2,1)) *(R-(T2 +RELART(J) -PT(J2,1))/2.
     1 ) +  Q1*(ICYCL-T2) * ((ICYCL -T2)/2.0 - RELART (J))
     2 +  Q2* ( RELART(J)**2)/2.0
      GO TO 14
 80    W1 =(ICYCL - PT(J2,1))/2.0
       NS=COUNT(1,J) +COUNT(2,J)+ COUNT(3,J)
       GO TO 90
C  COMPUTE AVERAGE DELAY AND MAX QUEUE
 85   W1=(DR + GR) / ICYCL *3600 /(COUNT(1,J)+ COUNT(2,J)+COUNT(3,J))
      NS= SS*GP* TP/ ICYCL
 90   CONTINUE
      PRINT 99, W1, NS, GP, GR, DR, QR, R, SS, Q1, Q2, T2
 99   FORMAT (15H DEBUG PLATOON /  F10.1, I10, 9F10.3 )
      RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE EMITX(QPOL,LCODE,ISPD)
C
C          DETERMINES INTERSECTION HC AND CO EMISSIONS
C
C DETERMINE EMISSIONS FROM EACH OF 8 LINKS WHICH CONNECT TO AN INTERSEC-
C TION.  EMISS(KP, ) IS THE EMISSIONS ON THE KP TH LINK.  KP= 1,2,3,4
C INDEX THE NORTH, EAST, SOUTH, AND WEST APPROACH LINKS RESPECTIVELY.
C KP= 5,6,7,8 INDEX THE NORTH, EAST, SOUTH AND WEST DEPARTURE LINKS
C RESPECTIVELY.  THERE ARE 5 EMISSION FLUX-DENSITIES FOR EACH LINK.
C EMISS(KP,J) ARE THE EMISSIONS FROM THE J TH SEGMENT OF THE LINK. J=1,2
C ,3,4,5 INDEX THE ACCELERATION (STARTING AT THE UPSTREAM END OF THE
C LINK), STEADY CRUISE, DECELERATION, DECEL PLUS IDLING, AND ACCEL PLUS
C IDLING SECTIONS OF THE LINK RESPECTIVELY.  --SIMMON
C
      DIMENSION CMISS(4,4)
      DIMENSION  DQ(4), DIST(4),  TIME(4),CCOUNT(4)
      COMMON /INSECT/ITYPC,ICYCL,IFLAG,CI,TP,W1,NS,VOL(4,3),PH(4),GCAP(4
     1),RELART(4),NAL(4),DELA(4,3),DELAI(8),QQ(4,3),PT(4,3),Y(4,3),CAP(4
     2,3),YT(4),QUEUE(4),COUNT(4,4)   ,NSTOPS(4),PFRAC(4)
      COMMON /TRAF/ DLINK(8,5), NLINK, Q(8,5,2), HEIGHT(8), NLANE(8)
     1,ZCONST
      COMMON /XY/ X1(8), X2(8), Y1(8), Y2(8)
      DIMENSION QPOL(3),  ISPD(8)
      COMMON/MODAL/EMACC(2,20),EMDEC(2,20),EMCRU(2,20),EMIDL(2)
      COMMON/ODDEND/NTLNK,IYEAR,IHOUR,IDAY,ISEA
      DIMENSION EMISS(8,5),VEL(8)
      DATA YES/3HYES/
      MAXCY=IYEAR-1900
      CALL MODMOD(MAXCY,LCODE,ACC)
C  DETERMINE AN AREA OF ACCELERATION, DECEL, AND IDLE BASED ON Q OR STOPS
C
      DO  106  KP =1,4
      IF( NLANE(KP) .GT. 0)
     1 DQ(KP) = QUEUE(KP)*26.3/NLANE(KP)
  106 DIST(KP) = SQRT (( X1(KP)-X2(KP))**2 + (Y1(KP)-Y2(KP))**2)*52.8
C
C
      DO 108 KP =1, 8
      DO 108 LS =1, 5
      Q(KP, LS,  1) = 0.0
      Q(KP, LS,  2) = 0.0
      VEL(KP) =  ISPD(KP)* 3.0 -1.5
      IF(VEL(KP) .LE. 0.0) VEL(KP) = 19.6
  108 DLINK( KP, LS)= 0.0
      DO  898  IQ = 1,2
      IF (QPOL (IQ) .NE. YES) GO TO 898
C
C     ACCELERATION RATE RETURNED FROM MODMOD.
      ACC=ABS(ACC)
      ACCR=ACC*5280./3600.
```

```
5000 FORMAT(1H1)
      PRINT 110
 110  FORMAT(10H-EMISSIONS/131H LINK STOPS QUE  VOL  VEL    Q-ACCEL  DIS
     1TANCE Q-AT-SPEED  DISTANCE    Q-DECEL  DISTANCE Q-IDL-DC-AC DISTAN
     2CE Q-IDL-AC-DC DISTANCE   )
      DO 100 KP=1,4
      CCOUNT(KP)=COUNT(1,KP) + COUNT(2,KP)+ COUNT(3,KP)
      IF (CCOUNT(KP) .LE.0.0) GO TO 78
      V = VEL(KP) * 5280./3600.
      IF(NSTOPS(KP).LE.00) GO TO 19
      TT2 = (DELA(KP,1)*COUNT(1,KP) + DELA(KP,2)*COUNT(2,KP) + DELA(KP,3
     1)*COUNT(3,KP))/NSTOPS(KP)
      TIME(2)=V/ACCR
      TIME(4)=TIME(2)
      DIS1=TIME(2)*V/2.
      DISDC = DIST(KP) - 2.*DIS1 -DQ(KP)
      IF(DISDC .GE. 0.0) GO TO 3
      DIS1=AMAX1(DIS1+DISDC/2.,0.0)
      DISDC=0.0
    3 DIS2=DIS1
      TIME(1)=DISDC/V
C   THE TIME SPENT IDLING IS THE AVERAGE DELAY MINUS THE DECEL DELAY
      TIME(3) = TT2 - TIME(2)/2.0
      IF (TIME(3).GE.0.0) GO TO 5
      TIME(2) = AMAX1( TIME(2) +TIME(3), 0.0)
      TIME(3)=0.0
      TIME(4)=TIME(2)
    5 CONTINUE
      GO TO 22
  19   CONTINUE
      TT2 =(DELA(KP,1)*COUNT(1,KP) +DELA(KP,2)*COUNT(2,KP) + DELA(KP,3)
     1 *COUNT(3,KP) )/ CCOUNT(KP)
      IF( TT2 .LE. 0.0) GO TO 24
C  THERE IS NO STOPPED DELAY BUT THERE IS DELAY
       DIS1 = 0.0
       DISDC = DIST(KP)
      DIS2=DIS1
      DQ(KP)=0.0
      TIME(1)=DISDC/V
       V =  DISDC/ (TIME(1) + TT2)
       TIME(2) = 0.0
      TIME(3)=0.0
      TIME(4)=TIME(2)
      GO TO 22
   24 CONTINUE
C  THERE IS NO QUEUE AND NO STOPS
      DIS1=0.0
      DIS2=DIS1
      DISDC=DIST(KP)
      TIME(1)=DISDC/V
      TIME(3) = TIME(2)
      TIME(4) = TIME(2)
   22 CONTINUE
C
C     COMPUTE EMISSIONS FOR THOSE NOT DELAYED
C     PLUS CONSTANT CRUISE FOR THOSE DELAYED.
C
      EMIS=EMCRU(IQ,ISPD(KP))/(V*0.3048)
      CMISS(KP,1) = EMIS
C
C    COMPUTE EMISSIONS DURING STOPPED TIME FOR DELAYED CARS
C
      CMISS(KP,3) = 0.0
      IF(DQ(KP).GT.0.0) CMISS(KP,3)=EMIDL(IQ)*TIME(3)/(DQ(KP)*0.3048)
C
C   COMPUTE EMISSIONS DURING DECELERATION AND ACCELERATION
C
      CMISS(KP,4)=EMACC(IQ,ISPD(KP))     /(V*0.3048)
      CMISS(KP,2)=EMDEC(IQ,ISPD(KP))     /(V*0.3048)
C
C   DETERMINE AND STORE DISTANCE FOR EACH LINK SECTION
C
      DLINK(KP,1) = DIS2 *.3048
      NDS3 = 0
      NS1 = 0
      IF(DQ(KP) .LE. 0.0) GO TO 72
      NDS3 = NSTOPS(KP)* DIS1/ DQ(KP)
      NS1 =  NSTOPS(KP)*DIS2/DQ(KP)
   72 DLINK(KP,2) = DISDC *.3048
      DLINK (KP,3)= DLINK(KP,1)
      DLINK(KP,4) = AMAX1(DIST(KP) - DIS1 - DIS2 - DQ(KP)/2.0- DISDC,
     1 0.0) *.3048
      DLINK(KP,5) =(DIST(KP) - DIS1 - DIS2-DISDC)*.3048 - DLINK(KP,4)
      EMISS(KP,2) =  EMIS*CCOUNT(KP)/TP
      IF( DQ(KP) .LT. DIS2) GO TO 74
      EMISS(KP,1) =(EMIS*CCOUNT(KP) +  NS1*(CMISS(KP,4)-EMIS)/2.0)/TP
      EMISS(KP,3) =( EMIS *CCOUNT(KP) + NDS3 *(CMISS(KP,2)-EMIS)/2.0)/TP
      IF(DQ(KP) .LE. 0.0) GO TO 77
      IF ( DIS2   .LE.  DQ(KP)/2.0)  GO TO  76
      EMISS(KP,4) =(EMIS*CCOUNT(KP) + NSTOPS(KP)*(CMISS(KP,3)*0.5 +
     1 (DIS1/DQ(KP) -.25 )*(CMISS(KP,2)-EMIS)+.25*(CMISS(KP,4)-EMIS))
     2 + NDS3*(1.0-DIS1/DQ(KP))*(CMISS(KP,2)-EMIS) )/TP
      EMISS(KP,5) =(EMIS*CCOUNT(KP) +  NSTOPS(KP)*(CMISS(KP,3)*1.5 +
     1 ( DIS2/DQ(KP) -.25)*(CMISS(KP,4)-EMIS) + .25*(CMISS(KP,2)-EMIS))
     2 + NS1*(1.0 -DIS2/DQ(KP))*(CMISS(KP,4) -EMIS) )/ TP
      GO TO 80
   74 EMISS(KP,1) = (EMIS *CCOUNT(KP) + NSTOPS(KP)*(1.0- DQ(KP)/(2.0*
     1 DIS2)) *(CMISS(KP,4) -EMIS) )/TP
C  IF DQ .LT. DIS2 THEN IT IS ASSUMED DQ .LT. DIS1 ALSO
      EMISS(KP,3) = (EMIS*CCOUNT(KP) +  NSTOPS(KP)*(1.0- DQ(KP)/(2.0 *
       EMISS(KP,4) = (EMIS*CCOUNT(KP) +  NSTOPS(KP)*(CMISS(KP,3)*0.5  +
     1 0.75*(CMISS(KP,2) - EMIS)  + 0.25*(CMISS(KP,4) - EMIS) ) ) /TP
       EMISS(KP,5) = (EMIS*CCOUNT(KP) +  NSTOPS(KP)*(CMISS(KP,3)*1.5  +
     1 0.25*(CMISS(KP,2) -EMIS) + 0.75*(CMISS(KP,4) -EMIS) ) ) /TP
       GO TO 80
76     EMISS(KP,4) =(EMIS* CCOUNT(KP) +   CMISS(KP,3)* 0.5* NSTOPS(KP) +
     1 NDS3*(CMISS( KP,2) -EMIS)   +  NSTOPS(KP)*DIS2/DQ(KP)*(1.0-DIS1
     2 /DQ(KP))*(CMISS(KP,4) - EMIS))/TP
       EMISS(KP,5) =(EMIS* CCOUNT(KP) + CMISS(KP,3)*1.5 * NSTOPS(KP) +
     1 NS1 *(CMISS( KP,4) -EMIS)   +  NSTOPS(KP)*DIS1/DQ(KP)*(1.0-DIS1
     2 /DQ(KP))*(CMISS(KP,2) - EMIS))/TP
       GO TO 80
77     EMISS(KP,4) = EMISS(KP,3)
       EMISS(KP,5) = EMISS(KP,1)
       GO TO 80
78     DO 79 J = 1,5
       DLINK(KP,J) = 0.0
79     EMISS(KP,J) = 0.0
   80 CONTINUE
  100 CONTINUE
       DO 83 J =1,5
       EMISS(5,J) = 0.0
       IF(CCOUNT(1) .NE. 0.0)
     1EMISS( 5  ,J)= EMISS( 1,J)*(COUNT(1,3)+COUNT(2,2)+COUNT(3,4))/
     1CCOUNT(1)
       IF(CCOUNT(3) .NE. 0.0) EMISS(5,J) = EMISS(3,J)*(COUNT(1,3)+COUNT(2
     1,2)+COUNT(3,4))/CCOUNT(3)
       EMISS(6,J) = 0.0
       IF(CCOUNT(2) .NE. 0.0)
     1EMISS( 6  ,J)= EMISS( 2,J)*(COUNT(1,4)+COUNT(2,3)+COUNT(3,1))/
     1CCOUNT(2)
       IF(CCOUNT(4) .NE. 0.0) EMISS(6,J) = EMISS(4,J)*(COUNT(1,4)+COUNT(2
     1,3)+COUNT(3,1))/CCOUNT(4)
       EMISS(7,J) = 0.0
       IF(CCOUNT(3) .NE. 0.0)
     1EMISS( 7  ,J)= EMISS( 3,J)*(COUNT(1,1)+COUNT(2,4)+COUNT(3,2))/
     1 CCOUNT(3)
       IF(CCOUNT(1) .NE. 0.0) EMISS(7,J) = EMISS(1,J)*(COUNT(1,1)+COUNT(2
     1,4)+COUNT(3,2))/CCOUNT(1)
       EMISS(8,J) = 0.0
       IF(CCOUNT(4) .NE. 0.0)
     1EMISS( 8  ,J)= EMISS( 4,J)*(COUNT(2,1)+COUNT(1,2)+COUNT(3,3))/
     1CCOUNT(4)
       IF(CCOUNT(2) .NE. 0.0) EMISS(8,J) = EMISS(2,J)*(COUNT(2,1)+COUNT(1
     1,2)+COUNT(3,3))/CCOUNT(2)
       DLINK(5,J) = DLINK(1,J)
       IF(CCOUNT(3) .NE. 0.0) DLINK(5,J) = DLINK(3,J)
       DLINK(6,J) = DLINK(2,J)
       IF(CCOUNT(4) .NE. 0.0) DLINK(6,J) = DLINK(4,J)
       DLINK(7,J) = DLINK(3,J)
```

```
      DLINK(8,J) = DLINK(4,J)
      IF(CCOUNT(2) .NE. 0.0) DLINK(8,J) = DLINK(2,J)
   83 CONTINUE
      DO 87 KP = 1,4
      IF(EMISS(KP+4,1) .GT. EMISS(KP+4,2))GO TO 85
      DLINK(KP+4,1) = DIST(KP)*.3048 -DLINK(KP+4,2)-DLINK(KP+4,3)-
     1DLINK(KP+4,4)-DLINK(KP+4,5)
      DLINK(KP+4,1) = AMAX1(DLINK(KP+4,1),0.0)
      GO TO 87
   85 DLINK(KP+4,2) = DIST(KP)*.3048 - DLINK(KP+4,1) -DLINK(KP+4,3)-
     1DLINK(KP+4,4)-DLINK(KP+4,5)
      DLINK(KP+4,2) = AMAX1(DLINK(KP+4,2),0.0)
   87 CONTINUE
      DO 896 KP=1,8
      DO  896  LS =1,5
  896 Q (KP, LS, IQ) =  EMISS( KP, LS)
      DO 897 KP = 1,4
      DQP = DQ(KP)*.3048
      VP = VEL(KP)* .3048*5280./3600.
      PRINT 111, KP,NSTOPS(KP),DQP, CCOUNT(KP), VP,(Q(KP,JM,IQ),
     1DLINK(KP,JM), JM =1,5)
  111 FORMAT (2I5,3F5.0,5(E11.4,E10.4))
  897 CONTINUE
      PRINT 984 , (KP,(Q(KP,JM,IQ),DLINK(KP,JM),JM=1,5),KP=5,8)
  984 FORMAT (4 (I5, 20X, 5(E11.4, E10.4)/))
  898 CONTINUE
         RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
         END
      SUBROUTINE MODMOD(MAXCY,ILOC,ACC)
C
C
C     DETERMINES MODAL HC AND CO EMISSION FACTORS FOR
C     INTERSECTION MODEL.--PATTERSON
C
C
      COMMON/MODAL/EMACC(2,20),EMDEC(2,20),EMCRU(2,20),EMIDL(2)
      DIMENSION EMACC1(18,2,20),EMDEC1(18,2,20),EMCRU1(18,2,20),
     1EMACMY(20,2,20),EMDEMY(20,2,20),EMCRMY(20,2,20)
      DIMENSION TREG(3)
      COMMON/COEF/BAD(12,2,18)
      COMMON/BASE/X(12),Y(3)
      COMMON/FACTS/UPDATE(20,2),DEFAC(20,2),IGROP(45,3),DETER(20,2),
     1SMODAT(20,2)
C
C
C
C     DATA IN COMMON BLOCK COMING ARE EXPECTED FROM MOBILE1.
C
      COMMON/COMING/FMODYR(20),CORFAC(20,20,2),EMIDLE(2)
C
C
      CHARACTER*9 IREG/'LOW ALT. ','CALIF.   ','HIGH ALT.'/
C
C
C     DATA SET IGROP ASSOCIATES A MODAL MODEL GROUP WITH EACH MODEL
C      YEAR 1951 - 1995 FOR EACH REGION.
      DATA IGROP/
     * 17*2,4,5,6,7,16,17,17,21*18,
     1 15*2,3,3,4,5,6,7,14,15,15,21*18,
     2 17*1,8,9,10,11,12,13,13,21*18/
      DO 800 I=1,40
      EMACC(I,1)=0.0
      EMCRU(I,1)=0.0
      EMDEC(I,1)=0.0
  800 CONTINUE
      DO 801 I=1,720
      EMACC1(I,1,1)=0.0
      EMDEC1(I,1,1)=0.0
      EMCRU1(I,1,1)=0.0
  801 CONTINUE
      DO 802 I=1,800
      EMACMY(I,1,1)=0.0
      EMDEMY(I,1,1)=0.0
      EMCRMY(I,1,1)=0.0
  802 CONTINUE
C
C
C
```

```
      EMIDL(2)=EMIDLE(2)
C
C
C
      IF(MAXCY.LT.75) GO TO 1100
      CALL COEFFS
      DO 100 ISPD=1,20
      SPD=ISPD*3.0-1.5
C     CALCULATE ACCELERATION EMISSIONS.
      ACC=2.5
      CALL BASIS(SPD,ACC,HOA,SOA)
      DO 40 IGROUP=1,18
      DO 30 IPOL=1,2
      DO 20 IBASE=1,9
   20 EMACC1(IGROUP,IPOL,ISPD)=EMACC1(IGROUP,IPOL,ISPD)+X(IBASE)*SOA*
     1BAD(IBASE,IPOL,IGROUP)
      IF(HOA.EQ.0.0) GO TO 30
      DO 10 IBASE=10,12
   10 EMACC1(IGROUP,IPOL,ISPD)=EMACC1(IGROUP,IPOL,ISPD)+X(IBASE)*SOA*
     1BAD(IBASE,IPOL,IGROUP)
   30 CONTINUE
   40 CONTINUE
C     CALCULATE DECELERATION EMISSIONS.
      ACC=-2.5
      CALL BASIS(SPD,ACC,HOA,SOA)
      DO 80 IGROUP=1,18
      DO 70 IPOL=1,2
      DO 60 IBASE=1,9
   60 EMDEC1(IGROUP,IPOL,ISPD)=EMDEC1(IGROUP,IPOL,ISPD)+X(IBASE)*SOA*
     1BAD(IBASE,IPOL,IGROUP)
      IF(HOA.EQ.0.0) GO TO 70
      DO 50 IBASE=10,12
   50 EMDEC1(IGROUP,IPOL,ISPD)=EMDEC1(IGROUP,IPOL,ISPD)+X(IBASE)*SOA*
     1BAD(IBASE,IPOL,IGROUP)
   70 CONTINUE
   80 CONTINUE
C     CALCULATE CRUISE EMISSIONS.
      DO 90 IGROUP=1,18
      DO 90 IPOL=1,2
      DO 90 IBASE=1,3
      IBASEY=IBASE+9
   90 EMCRU1(IGROUP,IPOL,ISPD)=EMCRU1(IGROUP,IPOL,ISPD)+Y(IBASE)*
     1BAD(IBASEY,IPOL,IGROUP)
  100 CONTINUE
      CALL DETERF(MAXCY,ILOC)
C     CHANGE FROM GROUP DESIGNATIONS TO MODEL YEAR DESIGNATIONS FOR THIS
C       LOCATION (LOW ALTITUDE,CALIFORNIA,HIGH ALTITUDE).
C     APPLY FACTORS FROM SUBROUTINE DETERF.
      MAXAGE=MAXCY-50
      MINAGE=MAXAGE-19
      IAGE=MAXAGE-INDEX+1
      IAGGY=21-IAGE
      DO 110 IPOL=1,2
      DO 110 ISPD=1,20
      EMACMY(IAGE,IPOL,ISPD)=EMACC1(IGROP(INDEX,ILOC),IPOL,ISPD)
     1*UPDATE(IAGE,IPOL)*DEFAC(IAGE,IPOL)*FMODYR(IAGGY)
     2*SMODAT(IAGE,IPOL)*DETER(IAGE,IPOL)
      EMDEMY(IAGE,IPOL,ISPD)=EMDEC1(IGROP(INDEX,ILOC),IPOL,ISPD)
     1*UPDATE(IAGE,IPOL)*DEFAC(IAGE,IPOL)*FMODYR(IAGGY)
     2*SMODAT(IAGE,IPOL)*DETER(IAGE,IPOL)
  110 EMCRMY(IAGE,IPOL,ISPD)=EMCRU1(IGROP(INDEX,ILOC),IPOL,ISPD)
     1*UPDATE(IAGE,IPOL)*DEFAC(IAGE,IPOL)*FMODYR(IAGGY)
     2*SMODAT(IAGE,IPOL)*DETER(IAGE,IPOL)
  120 CONTINUE
C     COLLAPSE MODEL YEARS EMISSIONS INTO ONE FACTOR.
C     APPLY CORRECTION FOR AIR CONDITIONING, TEMPERATURE, COLD STARTS,
C       AND VEHICLE MIX FROM MOBILE1.
      DO 130 IAGE=1,20
      DO 130 IPOL=1,2
      DO 130 ISPD=1,20
      EMACC(IPOL,ISPD)=EMACC(IPOL,ISPD)+EMACMY(IAGE,IPOL,ISPD)
     1*CORFAC(IAGE,ISPD,IPOL)
      EMDEC(IPOL,ISPD)=EMDEC(IPOL,ISPD)+EMDEMY(IAGE,IPOL,ISPD)
     1*CORFAC(IAGE,ISPD,IPOL)
  130 EMCRU(IPOL,ISPD)=EMCRU(IPOL,ISPD)+EMCRMY(IAGE,IPOL,ISPD)
     1*CORFAC(IAGE,ISPD,IPOL)
C     CONVERT ACCELERATION AND DECELERATION EMISSIONS TO GM/SEC.
      DO 500 IPOL=1,2
      DO 500 ISPD=1,20
      SPD=3.0*ISPD-1.5
      T=ABS(SPD/ACC)
      EMACC(IPOL,ISPD)=EMACC(IPOL,ISPD)/T
  500 EMDEC(IPOL,ISPD)=EMDEC(IPOL,ISPD)/T
      ICALYR=MAXCY+1900
      WRITE(6,700) IREG(ILOC),ICALYR
  700 FORMAT(1H1,45HAVERAGE EMISSIONS PER VEHICLE (GM/SEC) FOR A ,A9,13H
     1 LOCATION IN ,I4,1H.)
      WRITE(6,701)
  701 FORMAT(1H0,16X,12HHYDROCARBONS,35X,15HCARBON MONOXIDE)
      WRITE(6,702)
  702 FORMAT(1H ,5HSPEED,/,6H (MPH),2X,5HACCEL,9X,5HDECEL,8X,6HCRUISE,
     116X,5HACCEL,9X,5HDECEL,8X,6HCRUISE)
      DO 703 ISPD=1,20
      SPD=ISPD*3.0-1.5
  703 WRITE(6,704) SPD,(EMACC(IPOL,ISPD),EMDEC(IPOL,ISPD),EMCRU(IPOL,ISP
     1D),IPOL=1,2)
  704 FORMAT(1H0,1X,F4.1,3(F7.3,7X),7X,3(F7.3,7X))
      GO TO 1500
 1100 WRITE(6,5002)
 5002 FORMAT(1H0,68HMODAL EMISSIONS CANNOT BE CALCULATED FOR CALENDAR YE
 1500 CONTINUE
      RETURN
C**   THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE COEFFS
C     THIS SUBROUTINE PUTS THE MODAL MODEL COEFFICIENTS INTO AN ARRAY.
C     THE COEFFICIENTS ARE USED WITH THE BASIS FUNCTIONS TO CALCULATE
C        MODAL EMISSIONS.  AN UPDATE IN THE MODAL MODEL COEFFICIENTS MAY
C        BE INCORPORATED BY MODIFYING THE COEFFICIENTS IN THIS SUBROUTINE
C     THE SUBSCRIPTS IN VARIABLE BAD DENOTE 12 COEFFICIENTS,
C        2 POLLUTANTS, AND 18 MODEL GROUPINGS.  COEFFICIENTS 1-9 ARE FOR
C        STRICTLY ACCELERATION AND DECELERATION, AND 10-12 ARE FOR
C        STRICTLY CRUISE MODES.--PATTERSON
C     POLLUTANT 1 = HC
C     POLLUTANT 2 = CO
      COMMON/COEF/BAD(6,4,18)
      DATA ((BAD(I,J,1),I=1,6),J=1,4)/
     *  0.90408921E-01,-0.43798499E-02, 0.46575181E-02, 0.46570692E-03,
     *  0.82166778E-04,-0.11397827E-01, 0.13474836E-02,-0.36643314E-05,
     * -0.22224063E-04, 0.30548215E-01,-0.22557352E-03, 0.16962629E-04,
     *  0.10210419E+01,-0.46106476E-01, 0.12750413E-01, 0.19804664E-01,
     *  0.10487151E-02,-0.15174127E+00, 0.19398060E-01,-0.79918522E-04,
     * -0.27256622E-03, 0.33066291E+00,-0.24132896E-02, 0.32060244E-03/
      DATA ((BAD(I,J,2),I=1,6),J=1,4)/
     *  0.74031651E-01,-0.30712544E-02, 0.60856193E-02, 0.21202014E-03,
     *  0.57630212E-04,-0.73382109E-02, 0.88895089E-03,-0.11810998E-05,
     * -0.14498754E-04, 0.27507048E-01,-0.28579007E-03, 0.14516227E-04,
     *  0.63576120E+00,-0.24510358E-01, 0.43812852E-01, 0.49628541E-02,
     *  0.44958130E-03,-0.47973134E-01, 0.61538182E-02, 0.10994070E-04,
     * -0.67511966E-04, 0.30338836E+00,-0.27355787E-02, 0.13473761E-03/
      DATA ((BAD(I,J,3),I=1,6),J=1,4)/
     *  0.27212832E-01,-0.38454239E-03, 0.23166770E-02, 0.44772075E-03,
     *  0.15004828E-04,-0.76230941E-03, 0.21233164E-03,-0.50537274E-05,
     * -0.34107507E-05, 0.18768396E-01, 0.22212604E-03, 0.27737669E-05,
     *  0.28043038E+00,-0.47583580E-02, 0.43524541E-01, 0.13808063E-02,
     *  0.10754808E-03,-0.21531656E-02, 0.93090301E-03, 0.11250070E-04,
     * -0.19257031E-05, 0.22921783E+00,-0.40214434E-02, 0.12248126E-03/
      DATA ((BAD(I,J,4),I=1,6),J=1,4)/
     *  0.47496643E-01,-0.19568307E-02, 0.40773861E-02, 0.41705192E-04,
     *  0.35876787E-04,-0.48935749E-02, 0.59369067E-03,-0.25508832E-07,
     * -0.92721875E-05, 0.21479022E-01,-0.22617164E-03, 0.71491559E-05,
     *  0.49613750E+00,-0.14627926E-01, 0.61504323E-01,-0.10729437E-02,
     *  0.21254545E-03,-0.68023652E-02, 0.97647379E-03, 0.10525828E-03,
     *  0.37405029E-04, 0.26291054E+00,-0.18189936E-02, 0.84008745E-04/
      DATA ((BAD(I,J,5),I=1,6),J=1,4)/
     *  0.48391886E-01,-0.20854692E-02, 0.25164301E-02, 0.13065564E-03,
     *  0.36623620E-04,-0.58513656E-02, 0.63295290E-03,-0.47845251E-07,
     * -0.93267872E-05, 0.19670408E-01,-0.24843938E-03, 0.80316249E-05,
     *  0.50066710E+00,-0.17586585E-01, 0.59339337E-01,-0.18133272E-02,
     *  0.22920808E-03,-0.12368988E-01, 0.11492474E-02, 0.74215845E-04,
     *  0.14108437E-04, 0.30531263E+00,-0.70244968E-02, 0.10785337E-03/
      DATA ((BAD(I,J,6),I=1,6),J=1,4)/
     *  0.26139319E-01,-0.88184210E-03, 0.29786373E-02, 0.52868199E-05,
     *  0.18847655E-04,-0.19127505E-02, 0.25880150E-03, 0.16556996E-05,
*  0.39664203E+00,-0.13213880E-01, 0.58552373E-01,-0.19716325E-02,
*  0.16135792E-03,-0.43251887E-02, 0.21358313E-03, 0.86380664E-04,
*  0.40023762E-04, 0.24617422E+00,-0.68550445E-02, 0.10254829E-03/
 DATA ((BAD(I,J,7),I=1,6),J=1,4)/
*  0.22663523E-01,-0.80241775E-03, 0.20660437E-02, 0.71488132E-04,
*  0.16468533E-04,-0.15534335E-02, 0.21698159E-03, 0.52437150E-06,
* -0.24381525E-05, 0.10398161E-01,-0.82791143E-04, 0.51495617E-05,
*  0.36676234E+00,-0.14121491E-01, 0.68226576E-01,-0.32857144E-02,
*  0.18291990E-03, 0.22933292E-02, 0.19526284E-04, 0.13627447E-03,
*  0.54617223E-04, 0.22517568E+00,-0.46133995E-02, 0.69841262E-04/
 DATA ((BAD(I,J,8),I=1,6),J=1,4)/
*  0.43856181E-01,-0.21134645E-02, 0.17915356E-02, 0.34610229E-03,
*  0.46185669E-04,-0.66099726E-02, 0.83727646E-03,-0.14535626E-05,
* -0.13788690E-04, 0.17964281E-01,-0.16962083E-03, 0.14447384E-04,
*  0.10577946E+01,-0.67509890E-01, 0.62050894E-01, 0.11177700E-01,
*  0.14054242E-02,-0.17354453E+00, 0.21822363E-01, 0.12219173E-03,
* -0.29136962E-03, 0.30515999E+00,-0.65815225E-02, 0.36294828E-03/
 DATA ((BAD(I,J,9),I=1,6),J=1,4)/
*  0.32872163E-01,-0.14912151E-02, 0.16478680E-02, 0.17867390E-03,
*  0.30185285E-04,-0.37381337E-02, 0.46735839E-03, 0.11268759E-06,
* -0.71298127E-05, 0.14543414E-01, 0.14004891E-05, 0.93993158E-05,
*  0.68093568E+00,-0.48967101E-01, 0.90703070E-01, 0.41544996E-02,
*  0.97224675E-03,-0.92593908E-01, 0.13378501E-01, 0.19100340E-03,
* -0.13010977E-03, 0.19975567E+00,-0.77630468E-02, 0.33748685E-03/
 DATA ((BAD(I,J,10),I=1,6),J=1,4)/
*  0.51108368E-01,-0.25070298E-02, 0.78906864E-03, 0.43855957E-03,
*  0.49117531E-04,-0.68533719E-02, 0.80447760E-03,-0.30797009E-05,
* -0.12975738E-04, 0.19100837E-01,-0.17357615E-03, 0.11204482E-04,
*  0.10887880E+01,-0.71653783E-01, 0.56213565E-01, 0.12077432E-01,
*  0.14173663E-02,-0.18283314E+00, 0.22780791E-01, 0.11450195E-03,
* -0.30368124E-03, 0.31737489E+00,-0.97049810E-02, 0.31322357E-03/
 DATA ((BAD(I,J,11),I=1,6),J=1,4)/
*  0.39079703E-01,-0.19706031E-02, 0.38747867E-02, 0.97423879E-04,
*  0.41482446E-04,-0.33260076E-02, 0.43800077E-03, 0.56489025E-05,
* -0.44552689E-05, 0.12728568E-01,-0.24365130E-04, 0.85449728E-05,
*  0.12207556E+01,-0.89525878E-01, 0.95823228E-01, 0.61595142E-02,
*  0.17752303E-02,-0.19405907E+00, 0.24501167E-01, 0.30660117E-03,
* -0.31120144E-03, 0.30530828E+00,-0.67905560E-02, 0.22574072E-03/
 DATA ((BAD(I,J,12),I=1,6),J=1,4)/
*  0.54055668E-01,-0.26892500E-02,-0.10134301E-02, 0.19053000E-03,
*  0.56229997E-04,-0.55606700E-02, 0.69297990E-03,-0.89999997E-06,
* -0.11450000E-04, 0.12813311E-01,-0.21308000E-03, 0.12410000E-04,
*  0.14931040E+01,-0.10349673E+00, 0.72227307E-02, 0.59160888E-02,
*  0.20053601E-02,-0.23721021E+00, 0.26225589E-01, 0.23920002E-04,
* -0.39849989E-03, 0.32876998E+00,-0.91728717E-02, 0.29819994E-03/
 DATA ((BAD(I,J,13),I=1,6),J=1,4)/
*  0.36732789E-01,-0.19923900E-02,-0.88590011E-03, 0.37806993E-03,
*  0.46429996E-04,-0.41235089E-02, 0.56539010E-03,-0.27699998E-05,
* -0.89200003E-05, 0.12623239E-01,-0.26730006E-03, 0.11490000E-04,
*  0.11040087E+01,-0.79453886E-01, 0.56303188E-01, 0.17077201E-02,
     * -0.26381994E-03, 0.25955880E+00,-0.75969696E-02, 0.26727002E-03/
      DATA ((BAD(I,J,14),I=1,6),J=1,4)/
     *  0.27533840E-01,-0.15563599E-02, 0.40788017E-02, 0.91499996E-05,
     *  0.30790005E-04,-0.35172901E-02, 0.44818991E-03, 0.18999998E-06,
     * -0.56500003E-05, 0.89845918E-02,-0.49080001E-04, 0.56800000E-05,
     *  0.28853571E+00,-0.12315691E-01, 0.92407882E-01,-0.31504999E-02,
     *  0.16614000E-03, 0.70702210E-02, 0.46436000E-03, 0.14813000E-03,
     *  0.56589997E-04, 0.15976292E+00,-0.65233000E-02, 0.10359001E-03/
      DATA ((BAD(I,J,15),I=1,6),J=1,4)/
     *  0.26675239E-01,-0.14723700E-02, 0.33800800E-02, 0.89969995E-04,
     *  0.29100003E-04,-0.31962800E-02, 0.41041011E-03, 0.43800001E-05,
     * -0.43800001E-05, 0.88412911E-02,-0.75780001E-04, 0.42700003E-05,
     *  0.20974290E+00,-0.12848910E-01, 0.96859634E-01,-0.66359304E-02,
     *  0.18598999E-03, 0.21924630E-01,-0.15685901E-02, 0.27883006E-03,
     *  0.12293000E-03, 0.11387944E+00,-0.28685799E-02, 0.47189998E-04/
      DATA ((BAD(I,J,16),I=1,6),J=1,4)/
     *  0.44346619E-01,-0.22166700E-02, 0.68992004E-03, 0.13456000E-03,
     *  0.41330000E-04,-0.53420886E-02, 0.60573011E-03,-0.18299997E-05,
     * -0.96399999E-05, 0.13101980E-01,-0.24442002E-03, 0.81700000E-05,
     *  0.57665521E+00,-0.36277410E-01, 0.21571960E-01, 0.29442401E-02,
     *  0.63650007E-03,-0.52853432E-01, 0.69414489E-02,-0.17560000E-04,
     * -0.94470000E-04, 0.25530094E+00,-0.76948516E-02, 0.13530999E-03/
      DATA ((BAD(I,J,17),I=1,6),J=1,4)/
     *  0.26262619E-01,-0.11058000E-02, 0.13030299E-02, 0.63369996E-04,
     *  0.23860004E-04,-0.18674701E-02, 0.25699008E-03, 0.32999998E-06,
     * -0.31099999E-05, 0.10452788E-01,-0.19408000E-03, 0.67499996E-05,
     *  0.54005557E+00,-0.39594091E-01, 0.28321180E-01, 0.14426301E-02,
     *  0.70013991E-03,-0.57096951E-01, 0.73297806E-02, 0.53550000E-04,
     * -0.85880005E-04, 0.20601881E+00,-0.58017895E-02, 0.85580003E-04/
      DATA ((BAD(I,J,18),I=1,6),J=1,4)/
     *  0.80684014E-02,-0.40020002E-03, 0.90040010E-03, 0.65000000E-04,
     *  0.66000002E-05,-0.73569990E-03, 0.89800000E-04,-0.30000001E-06,
     * -0.60000002E-06, 0.53815991E-02,-0.14550000E-03, 0.19999998E-05,
     *  0.21578521E+00,-0.12577798E-01, 0.51477298E-01,-0.23425999E-02,
     *  0.16780000E-03,-0.15755999E-02, 0.28229994E-03, 0.12529999E-03,
     *  0.48500006E-04, 0.11655778E+00,-0.46298988E-02, 0.69899994E-04/
      RETURN
C**   THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE BASIS(SPD,ACC,HOA,SOA)
C     THIS SUBROUTINE RETURNS VALUES OF THE 12 BASIS FUNCTIONS OF THE
C       MODAL MODEL THAT ARE USED WITH THE COEFFICIENTS TO CALCULATE
C       MODAL EMISSIONS.  A CHANGE IN THE BASIS FUNCTIONS OF THE
C       MODAL MODEL MAY BE ICCORPORATED INTO APRAC BY MODIFYING THE
C       FUNCTIONS IN THIS SUBROUTINE.--PATTERSON
      COMMON/BASE/X(12),Y(3)
      TIME=ABS(SPD/ACC)
      T=TIME
      TT=T*T
      A=ACC
      ABSA=ABS(ACC)
      AA=ACC*ACC
      X(1)=T
      X(2)=ABSA*TT/2.
      X(3)=A*T
      X(4)=ABSA*A*TT/2.
      X(5)=AA*TT*T/3.
      X(6)=AA*T
      X(7)=ABSA*AA*TT/2.
      X(8)=AA*A*TT*T/3.
      X(9)=AA*AA*TT*T/3.
      X(10)=X(1)
      X(11)=X(2)
      X(12)=X(5)
      Y(1)=1.0
      Y(2)=SPD
      Y(3)=SPD*SPD
      AMAX=1.0
      AMIN=-1.2
      A1=-1.0/AMAX
      A2=-1.0/AMIN
      IF(A.GE.AMAX) HOA=0.
      IF(A.LE.AMIN) HOA=0.
      IF(A.GE.0.0.AND.A.LT.AMAX) HOA=(A1*A)+1.0
      IF(A.LE.0.0.AND.A.GT.AMIN) HOA=(A2*A)+1.0
      SOA=1.0-HOA
      RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE DETERF(MAXCY,ILOC)
C
C
C     THIS SUBROUTINE CALCULATES FOUR SETS OF FACTORS FOR USE IN
C       SUBROUTINE MODMOD.--PATTERSON
C
C     THE FIRST FACTOR, UPDATE(VEHICLE AGE, POLLUTANT), IS USED TO
C       CALCULATE MODAL EMISSIONS OF POST-1975 MODEL YEARS BY FORMING
C       THE RATIO OF FTP EMISSIONS IN THE MODEL YEAR (VEHICLE AGE = 1)
C       TO THE FTP LOW ALTITUDE 1975 MODEL YEAR EMISSIONS IN 1975.  THE
C       FACTOR IS MULTIPLIED BY THE GROUP 18 MODAL EMISSION MODEL
C       RESULTS TO FIND THE MODAL EMISSIONS OF THE LATER MODEL YEAR.
C
C     THE SECOND FACTOR, DEFAC(VEHICLE AGE, POLLUTANT), IS USED TO
C       DETERIORATE EMISSIONS TO THE CALENDAR YEAR OF INTEREST.  MODEL
C       YEARS 1975 AND EARLIER ARE DETERIORATED FROM 1975, WHILE LATER
C       MODEL YEARS ARE DETERIORATED FROM THE MODEL YEAR TO THE CALENDAR
C       YEAR OF INTEREST.  IT IS FORMED BY THE RATIO OF FTP EMISSIONS IN
C       THE CALENDAR YEAR TO FTP EMISSIONS IN THE MODEL YEAR (VEHICLE
C       AGE = 1) FOR POST-1975 VEHICLES.  VEHICLES FROM MODEL YEARS
C       1975 AND EARLIER USE A DENOMINATOR OF FTP EMISSIONS FOR THE
C       VEHICLE AGE IN 1975.
C
C     THE THIRD FACTOR, SMODAT(VEHICLE AGE, POLLUTANT), IS USED TO FILL
C       IN THE MODAL MODEL GROUPS USING THE SAME GROUPINGS AS MOBILE1.
C       THE FACTOR, WHICH APPLIES TO 1968-1971 AND 1975 CALIFORNIA AND
C       1975 HIGH ALTITUDE VEHICLES, IS FORMED BY THE RATIO OF THE FTP
C       EMISSIONS FOR THE MODEL YEAR AND LOCATION TO THE LOW ALTITUDE
C       FTP EMISSIONS IN THE SAME MODEL YEAR, BOTH CALCULATED AT THE
C       MODAL EMISSION MODEL LOW ALTITUDE VEHICLE TEST DATE MILEAGE FOR
C       THAT MODEL YEAR.
C
C     THE FOURTH FACTOR, DETER(VEHICLE AGE, POLLUTANT), WAS SUPPLIED BY
C       THE EPA WITH THE MODAL EMISSION MODEL FOR ALL VEHICLES EXCEPT
C       THOSE AFFECTED BY SMODAT.  THIS FACTOR IS USED TO DETERIORATE
C       EMISSIONS OF 1975 AND EARLIER MODEL YEARS TO MID-YEAR 1975.
C       FOR THE VEHICLES AFFECTED BY SMODAT, IT IS CALCULATED AS THE
C       RATIO OF THE FTP EMISSIONS IN 1975 TO THE FTP EMISSIONS
C       CALCULATED AT THE MODAL EMISSION MODEL TEST DATE MILEAGE.
C
C     DATA SETS BASE AND SLOPE CONTAIN THE INTERCEPT AND SLOPE VALUES TO
C       CALCULATE FTP EMISSIONS FOR 1951-1995 MODEL YEARS AT THREE
C       LOCATIONS, FOR THREE POLLUTANTS.  (SEE TABLES I-1, HI-I-1, AND
C       CAL-I-1 OF MOBILE1.)
C
C     DATA SET DETER CONTAINS THE FACTORS SUPPLIED BY THE EPA WITH THE
C       MODAL EMISSION MODEL TO DETERIORATE THE MODAL EMISSION ESTIMATES
C       TO JULY 1975.
C
C     DATA SET MILES CONTAINS THE MID-YEAR MILEAGE BY VEHICLE AGE(1-20).
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C         THE MODAL EMISSION TEST DATE, RUNNING BACKWARDS FROM 1975, FOR
C         USE IN CALCULATING SMODAT.  (THE ZERO ENTRIES ARE NOT USED.)
C
C
      DIMENSION BASE(45,3,2),SLOPE(45,3,2),BEMIS(2),MILES(28)
      DIMENSION SMILES(28),DETERS(18,2)
      COMMON/FACTS/UPDATE(20,2),DEFAC(20,2),IGROP(45,3),DETER(20,2),
     1SMODAT(20,2)
      DATA DETERS/
     * 0.303,0.343,0.513,0.515,0.521,0.594,0.740,0.447,0.401,
     1 0.470,0.514,0.204,0.167,0.248,0.158,0.260,0.184,-0.047,
     2 0.117,0.169,0.421,0.491,0.494,0.558,0.686,0.234,0.203,
     3 0.226,0.234,0.099,0.075,0.188,0.113,0.244,0.171,-0.037/
      DATA ((BASE(MY,ILOC,1),MY=1,45),ILOC=1,3)/
     117*4.45,7*2.43,5*1.13,16*0.13,
     215*4.45,9*2.00,2*0.29,19*0.15,
     317*6.03,7*4.07,2*1.83,0.70,2*1.83,0.21,3*0.21,12*0.13/
      DATA ((SLOPE(MY,ILOC,1),MY=1,45),ILOC=1,3)/
     117*0.58,7*0.53,5*0.23,16*0.23,
     215*0.58,9*0.70,2*0.23,19*0.23,
     324*0.55,21*0.23/
      DATA ((BASE(MY,ILOC,2),MY=1,45),ILOC=1,3)/
     117*68.30,7*31.14,5*18.60,3.00,15*1.40,
     215*68.30,9*30.42,2*3.80,4*3.80,15*3.00,
     317*110.04,7*76.73,2*38.31,10.30,2*38.31,6.18,3*2.88,12*1.40/
      DATA ((SLOPE(MY,ILOC,2),MY=1,45),ILOC=1,3)/
     117*3.06,7*6.15,5*2.80,2.30,15*2.00,
     215*3.06,9*6.40,2*2.33,4*2.33,15*2.00,
     317*2.81,7*4.24,5*2.80,2.30,15*2.00/
      DATA MILES/5962,19622,34369,48147,61022,72997,84044,94122,
     1103297,111571,118946,125646,132137,138265,144062,149462,154546,
     2159465,164090,168499,8800,0,0,0,15600,28700,39500,46400/
      DATA UPDATE/40*1.0/
      DATA SMODAT/40*1.0/
      DATA DEFAC/40*1.0/
      DATA DETER/40*0.0/
      DO 10 I=1,28
   10 SMILES(I)=MILES(I)/10000.0
C     FIND 1975 LOW ALTITUDE EMISSIONS.
      DO 15 IPOL=1,2
   15 BEMIS(IPOL)=BASE(25,1,IPOL)+SLOPE(25,1,IPOL)*SMILES(1)
C     FIND FACTORS FOR CALCULATING EMISSIONS IN LATER YEARS.
C     CALCULATE DETERIORATION FACTORS.
      MAXYR=MAXCY-50
      MINYR=MAXYR-19
      MODYR=75-50
      DO 40 IPOL=1,2
      DO 40 MYR=MINYR,MAXYR
      IAGE=MAXYR-MYR+1
      IAGE1=1
      DEFAC(IAGE,IPOL)=(BASE(MYR,ILOC,IPOL)+SLOPE(MYR,ILOC,IPOL)*
     1SMILES(IAGE))/(BASE(MYR,ILOC,IPOL)+SLOPE(MYR,ILOC,IPOL)*
     2SMILES(IAGE1))
      IF(MYR.LE.MODYR) GO TO 35
      UPDATE(IAGE,IPOL)=(BASE(MYR,ILOC,IPOL)+SLOPE(MYR,ILOC,IPOL)*
     1SMILES(1))/BEMIS(IPOL)
   35 DETER(IAGE,IPOL)=DETERS(IGROP(MYR,ILOC),IPOL)+1.0
      IF(ILOC.EQ.1) GO TO 40
      IF(MYR.LT.18.OR.MYR.GT.21.AND.MYR.NE.MODYR) GO TO 40
      BASE1=BASE(MYR,ILOC,IPOL)+SLOPE(MYR,ILOC,IPOL)*SMILES(IAGE1+20)
      BASE2=BASE(MYR,1,IPOL)+SLOPE(MYR,1,IPOL)*SMILES(IAGE1+20)
      BASE3=BASE(MYR,ILOC,IPOL)+SLOPE(MYR,ILOC,IPOL)*SMILES(IAGE1)
      SMODAT(IAGE,IPOL)=BASE1/BASE2
      DETER(IAGE,IPOL)=BASE3/BASE1
   40 CONTINUE
      RETURN
C**   THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE LINE(THETA,WS,ISTAB,XX1,XX2,YY1,YY2,CONC)
C
C
C     THIS ROUTINE COMPUTES THE CONCENTRATION AT A RECEPTOR RESULTING
C     FROM THE LINE SOURCES COMPRISING AN INTERSECTION
C     A LINE IS TREATED AS A SERIES OF POINT SOURCES--THE CONCENTRATIONS
C     AT THE RECEPTOR RESULTING FROM EACH POINT SOURCE ARE SUMMED TO
C     GIVE THE CONCENTRATION FROM THE LINE SOURCE--THEN THE CONCENTRA-
C     TIONS FROM EACH LINE SOURCE ARE SUMMED
C         ---SIMMON
C
      DIMENSION YC(5),YE(5),ZC(5),ZE(5),XX1(8),XX2(5),YY1(8),YY2(8),
     1CONNOR(2),CONC(2)
      COMMON/XYCOOR/X1,X2,Y1,Y2
      COMMON/RECEP/XO,YO
      COMMON/SIGMAS/YCOEFF,YEXP,ZCOEFF,ZEXP
      COMMON /TRAF/ DLINK(8,5), NLINK, Q(8,5,2), HEIGHT(8), NLANE(8)
     1,ZCONST
      DATA YC/0.40,0.40,0.36,0.32,0.31/,YE/0.91,0.91,0.86,0.78,0.71/,ZC/
     10.04,0.05,0.07,0.10,0.10/,ZE/1.37,1.26,1.13,1.00,0.85/
C
C     CONVERT METEOROLOGICAL WIND DIRECTION TO TRIGONOMETRIC DIRECTION,
C     WITH ZERO DEGREES ON THE POSITIVE X-AXIS AND PROCEEDING COUNTER-
C     CLOCKWISE
      THETAP=450.-THETA
      IF(THETAP.GT.360.) THETAP=THETAP-360.
C
C     DETERMINE DIFFUSION PARAMETERS
      YCOEFF=YC(ISTAB)
      YEXP=YE(ISTAB)
      ZCOEFF=ZC(ISTAB)
      ZEXP=ZE(ISTAB)
C
C     COMPUTE THE CONCENTRATION AT THE RECEPTOR FROM EACH LINE SOURCE
C     THAT IS PART OF THE INTERSECTION AND SUM THE RESULTS
        DO 8 IPOL=1,2
 8      CONC(IPOL)=0.
        DO 10 NLINK=1,8
        IF(NLANE(NLINK).EQ.0) GO TO 10
        X1=XX1(NLINK)*16.0934
        X2=XX2(NLINK)*16.0934
        Y1=YY1(NLINK)*16.0934
        Y2=YY2(NLINK)*16.0934
        HT=HEIGHT(NLINK)
        NLANES=NLANE(NLINK)
C
C     DETERMINE WHETHER ANY PART OF LINK IS UPWIND OF RECEPTOR--IF NOT,
C     BYPASS COMPUTATIONS
C     TRANSFORM LINK COORDINATES SO THAT + Y-AXIS IS IN DIRECTION FROM
C     WHICH WIND IS BLOWING AND ORIGIN IS AT RECEPTOR
```

```
      AA=SIN(EPSILO)
      AB=COS(EPSILO)
      BA=X1-X0
      BB=X2-X0
      BC=Y1-Y0
      BD=Y2-Y0
      X1TR=BA*AB+BC*AA
      X2TR=BB*AB+BD*AA
      Y1TR=BC*AB-BA*AA
      Y2TR=BD*AB-BB*AA
C    SEE IF BOTH ENDS OF LINK ARE DOWNWIND OF RECEPTOR--IF SO, BYPASS
C    COMPUTATIONS
      IF(Y1TR.LE.0.0.AND.Y2TR.LE.0.) GO TO 10
C     SEE IF ONE OR BOTH ENDS OF LINK LIE IN A 45 DEG PIE-SHAPED
C    SECTOR UPWIND OF RECEPTOR--IF SO, COMPUTE POLLUTANT CONCENTRATIONS
      IF(Y1TR.LE.0.) GO TO 1
      IF(ABS(ATAN(ABS(Y1TR/X1TR))).GE.45.*6.2831853/360.) GO TO 6
      IF(Y2TR.LE.0.) GO TO 100
 1    IF(ABS(ATAN(ABS(Y2TR/X2TR))).GE.45.*6.2831853/360.) GO TO 6
C    IF ONE OR BOTH ENDS OF LINK ARE OUTSIDE OF 45 DEG SECTOR, SEE IF
C    PART OF LINK PASSES THROUGH SECTOR--IF NOT, BYPASS COMPUTATIONS
100   IF(X1TR.GT.0.0.AND.X2TR.LT.0.) GO TO 7
      IF(X1TR.LT.0.0.AND.X2TR.GT.0.) GO TO 7
      GO TO 10
 7    YLKXWD=Y1TR-((Y1TR-Y2TR)/(X1TR-X2TR))*X1TR
      IF(YLKXWD.LT.0.) GO TO 10
C
C    CALL THE APPROPRIATE ROUTINE TO COMPUTE THE CONCENTRATION AT THE
C    RECEPTOR FROM EACH LINE SOURCE
  6  CALL CURTR (THETAP)
      CALL CONCAL(HT,THETAP,NLANES,CONNOR)
C
C    MAKE A RUNNING SUM OF THE RESULTS
        DO 9 IPOL=1,2
 9      CONC(IPOL)=CONC(IPOL)+CONNOR(IPOL)
10    CONTINUE
C
C    DIVIDE NORMALIZED CONCENTRATION BY PI AND WIND SPEED
     DO 11 IPOL=1,2
11   CONC(IPOL)=CONC(IPOL)/(3.14159265*WS)
    RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
    END
```

```
      SUBROUTINE CURTR (THETAP)
C
C
C     THIS ROUTINE COMPUTES THE COORDINATES (XX,YY) OF POINT TO BE THE
C     ORIGIN IN NEW COORDINATE SYSTEM AND THE ANGLE FROM THE WIND VECTOR
C     TO THE LINK.  IT THEN TRANSFORMS THE X,Y COORDINATES OF THE
C     RECEPTOR AND THE LINK END POINTS INTO A NEW SYSTEM WITH THE Y-AXIS
C     ALONG THE LINK AND WITH THE ORIGIN AT THE POINT OF INTERSECTION OF
C     THE LINK (OR ITS EXTENSION) AND THE WIND VECTOR
C      ---SIMMON
C
      COMMON/RECEP/XO,YO
      COMMON/XYCOOR/X1,X2,Y1,Y2
      COMMON/COORTR /X1NEW,X2NEW,Y1NEW,Y2NEW,XONEW,YONEW,ALPHA,A,XX,YY
C
C     COMPUTE THE SLOPE AND Y-INTERCEPT OF THE LINK--CHECK TO SEE IF
C     SLOPE IS INFINITE.  IF SO, SET SLOPE AND Y-INTERCEPT EQUAL TO ZERO
C     THIS WILL BE A CUE FOR VERTICAL LINKS.
      IF(X1.EQ.X2) GO TO 32
      AM=(Y1-Y2)/(X1-X2)
      B=Y1-AM*X1
      GO TO 31
 32   AM=0.
      B=0.
C
C     FIND (XX,YY) AND ALPHA
C     PERFORM CHECKS TO SEE IF THE ORIENTATION OF THE LINK AND WIND
C     VECTOR IS ONE OF SEVERAL SPECIAL CASES
 31   IF(THETAP.NE.90.0.AND.THETAP.NE.270.) GO TO 1
      IF(X1.EQ.X2) GO TO 4
      GO TO 2
 1    IF(X1.EQ.X2) GO TO 6
      A=TAN(THETAP*3.14159265/180.)
      IF(A.EQ.AM) GO TO 3
C
C     COMPUTE (XX,YY) AND ALPHA FOR NON-SPECIAL CASE WIND/LINK
C     ORIENTATION
      XX=(XO*A-YO+B)/(A-AM)
      YY=AM*XX+B
      ALPHA=ATAN2((AM-A),(AM*A+1.))
      GO TO 5
C
C     IN THIS CASE THE LINK IS PARALLEL TO THE OLD Y-AXIS BUT THE WIND
C     IS NOT
 6    XX=X1
      A=TAN(THETAP*3.14159265/180.)
      YY=(XX-XO)*A+YO
      ALPHA=ATAN2(1.,A)
      GO TO 5
C
```

```
C     IS NOT PARALLEL TO IT
 2    XX=XO
      YY=AM*XO+B
      ALPHA=ATAN2(1.,-AM)
      GO TO 5
C
C     IN THIS CASE THE WIND IS PARALLEL TO THE LINK BUT NOT TO THE OLD
C     Y-AXIS
 3    IF(AM.EQ.0.) GO TO 11
      AMPRIM =-1./AM
      GO TO 12
 11   XX=XO
      YY=Y1
      GO TO 7
 12   BPRIME=YO-AMPRIM *XO
      XX=(BPRIME-B)/(AM-AMPRIM )
      YY=AM*XX+B
      GO TO 7
C
C     IN THIS CASE THE WIND, THE LINK AND THE OLD Y-AXIS ARE ALL
C     PARALLEL
 4    XX=X1
      YY=YO
 7    ALPHA=0.
      GO TO 23
C
C     THE FOLLOWING STATEMENTS CHECK TO SEE IF THE ANGLE BETWEEN THE
C     LINK AND THE WIND VECTOR IS LESS THAN 1 DEGREE--IF SO, THE ANGLE
C     IS SET EQUAL TO 0.
 5    ZZ=Y1-Y2
      ZZZ=X1-X2
      ZETA=(ATAN2(ZZ,ZZZ))*180./3.14159265
      IF(ZETA.LT.0.) ZETA=180.+ZETA
      IF(ZETA.EQ.180.)ZETA=0.
      ZETA1=THETAP
      IF(ZETA1.GE.180.) ZETA1=ZETA1-180.
      IF(ABS(ZETA-ZETA1).LT.1.) GO TO 50
      GO TO 23
 50   IF(THETAP.EQ.90.0.OR.THETAP.EQ.270.) GO TO 4
      GO TO 3
C
C     TRANSFORM COORDINATES
C     COMPUTE THE ANGLE FROM OLD Y-AXIS TO NEW Y-AXIS (LINK), MEASURED
C     COUNTERCLOCKWISE
 23   IF(X1.EQ.X2) GO TO 21
      OMEGA=ATAN2(1.,-AM)
      GO TO 22
 21   OMEGA=0.
C
C     COMPUTE COORDINATES IN NEW SYSTEM
```

```
      SINE=SIN(OMEGA)
      X1NEW = 0.
      X2NEW = 0.
      Y1NEW=(Y1-YY)*COSINE-(X1-XX)*SINE
      Y2NEW=(Y2-YY)*COSINE-(X2-XX)*SINE
      XONEW=(YO-YY)*SINE+(XO-XX)*COSINE
      YONEW=(YO-YY)*COSINE-(XO-XX)*SINE
      RETURN
C**   THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE CONCAL(HT,THETAP,NLANES,CONNOR)
C
C
C     THIS ROUTINE CALCULATES THE NORMALIZED CONCENTRATION AT A RECEPTOR
C     RESULTING FROM EACH POINT (SEGMENT) ALONG THE LINK AND ADDS THESE
C     TO GIVE THE CONCENTRATION FROM THE LINK
C      ---SIMMON
C
      COMMON/RECEP/XO,YO
      COMMON/XYCOOR/X1,X2,Y1,Y2
      COMMON/SIGMAS/YCOEFF,YEXP,ZCOEFF,ZEXP
      COMMON /TRAF/ DLINK(8,5), NLINK, Q(8,5,2), HEIGHT(8), NLANE(8)
     1,ZCONST
      COMMON/COORTR /X1NEW,X2NEW,Y1NEW,Y2NEW,XONEW,YONEW,ALPHA,A,XX,YY
      DIMENSION GAMMA(6),CONNOR(2)
        DO 11 IPOL=1,2
 11     CONNOR(IPOL)=0.
      IF(XX.EQ.XO.AND.YY.EQ.YO.AND.ALPHA.EQ.1.570796) GO TO 15
C
C     COMPUTE DISTANCE TO BE TAKEN BETWEEN POINT SOURCES
      CALL SPACNG (DELTAY,YCONST,NLANES,NP,Y,GAMMA)
      IF(ALPHA.EQ.0.) GO TO 1
      A1=SIN(ALPHA)
      A2=COS(ALPHA)
      A3=XONEW/A1
C
C     DETERMINE THE SIGN OF THE X-DISTANCE BETWEEN A POINT ON THE LINK
C     OR ITS EXTENSION THAT IS UPWIND OF THE RECEPTOR ( THE SIGN OF THE
C     X-DISTANCE FOR POINTS DOWNWIND WILL BE OF OPPOSITE SIGN--COMPUTA-
C     TIONS WILL NOT BE MADE FOR DOWNWIND POINTS)
 1    CALL XSIGN(THETAP,A1,A2,A4)
C
C     COMPUTE CONCENTRATION RESULTING FROM EACH POINT ON LINK AND SUM
C     FOR ALL POINTS
        DO 100 K=1,NP
        Y=Y+DELTAY
        IF(ALPHA.EQ.0.) GO TO 2
        A5=A3-Y*A2
        GO TO 4
 2      A5=Y
 4      IF(A5.GT.0.0.AND.A4.LT.0.) GO TO 100
        IF(A5.LT.0.0.AND.A4.GT.0.) GO TO 100
        A6=ABS(A5)
        SIGY=YCOEFF*A6**YEXP+YCONST
        IF(ZCONST.LT.3.) ZCONST=3.
        SIGZ=ZCOEFF*A6**ZEXP+ZCONST
        IF(ALPHA.EQ.0.) GO TO 5
        A7=Y*A1/SIGY
        GO TO 6
 5      A7=XONEW/SIGY
```

```
        A9=0.5*(A7*A7+A8*A8)
        IF(A9.GE.65.) GO TO 100
          DO 10 II=1,5
          IF(Y.GT.GAMMA(II).AND.Y.LE.GAMMA(II+1)) GO TO 3
          IF(Y.GE.GAMMA(II+1).AND.Y.LT.GAMMA(II)) GO TO 3
 10       CONTINUE
 3      TEMPRY=SIGY*SIGZ*EXP(A9)
          DO 20 IPOL=1,2
 20       CONNOR(IPOL)=CONNOR(IPOL)+Q(NLINK,II,IPOL)/TEMPRY
 100    CONTINUE
        DO 21 IPOL=1,2
 21     CONNOR(IPOL)=CONNOR(IPOL)*DELTAY
 15   RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE SPACNG (DELTAY,YCONST,NLANES,NP,Y,GAMMA)
C
C
C     THIS ROUTINE COMPUTES THE DISTANCE TO BE TAKEN BETWEEN POINT
C     SOURCES AND CALCULATES THE VALUES OF VARIOUS PARAMETERS FOR USE IN
C     CONCAL
C     ---SIMMON
C
      COMMON/SIGMAS/YCOEFF,YEXP,ZCOEFF,ZEXP
      COMMON /TRAF/ DLINK(8,5), NLINK, Q(8,5,2), HEIGHT(8), NLANE(8)
     1,ZCONST
      COMMON/COORTR /X1NEW,X2NEW,Y1NEW,Y2NEW,XONEW,YONEW,ALPHA,A,XX,YY
      DIMENSION GAMMA(6)
C
C     COMPUTE SPACING
      IF(Y1NEW.LE.YONEW.AND.YONEW.LE.Y2NEW) GO TO 1
      IF(Y2NEW.LE.YONEW.AND.YONEW.LE.Y1NEW) GO TO 1
      ABC=ABS(YONEW-Y1NEW)
      ABD=ABS(YONEW-Y2NEW)
      IF(ABC.GT.ABD) GO TO 2
      DISTNC =SQRT(ABC*ABC+XONEW*XONEW)
      GO TO 3
 1    DISTNC =ABS(XONEW)
      GO TO 3
 2    DISTNC =SQRT(ABD*ABD+XONEW*XONEW)
  3   SIGYPR = YCOEFF * DISTNC ** YEXP
      DELTAY = 0.1906817 * SIGYPR
      IF(DELTAY.GE.1.5) GO TO 4
      DELTAY = 0.160145 * (SIGYPR+3.)
      IF(DELTAY.GE.1.5) GO TO 4
      YCONST =3.
      GO TO 5
 4    YCONST =DELTAY*2.
      YCL=6.*NLANES
      IF(YCONST .GT.YCL) YCONST =YCL
C
C     FIND NO. OF POINTS TO BE TAKEN ON LINK, THE POINTS THAT SEPARATE
C     AREAS OF DIFFERENT DRIVING MODES, AND THE STARTING POINT OF THE
C     LINK
 5    ALENGT =ABS(Y1NEW-Y2NEW)
      NP=ALENGT /DELTAY+0.9991
      DELTAY=ALENGT /NP
      GAMMA(1)=Y1NEW
        DO 11 II=2,6
        IF(Y1NEW.GT.Y2NEW) GO TO 6
        Y=Y1NEW-DELTAY/2.
        GAMMA(II)=GAMMA(II-1)+DLINK(NLINK,II-1)
        GO TO 11
 6      Y=Y2NEW-DELTAY/2.
        GAMMA(II)=GAMMA(II-1)-DLINK(NLINK,II-1)
      RETURN
C**   THIS PROGRAM VALID ON FTN4 AND FTN5 **
      END
      SUBROUTINE XSIGN(THETAP,A1,A2,A4)
C
C
C     THIS ROUTINE FINDS THE SIGN OF THE X-DISTANCE (USED IN THE POINT
C     SOURCE EQUATION) OF A POINT ON THE LINK OR ITS EXTENSION THAT
C     WOULD CONTRIBUTE TO THE CONCENTRATION AT THE RECEPTOR IF A SOURCE
C     WERE LOCATED AT THAT POINT
C      ---SIMMON
C
      COMMON/RECEP/XO,YO
      COMMON/XYCOOR/X1,X2,Y1,Y2
      COMMON/COORTR /X1NEW,X2NEW,Y1NEW,Y2NEW,XONEW,YONEW,ALPHA,A,XX,YY
      C1=XX-XO
      C2=YY-YO
      IF(C1.EQ.0.0.AND.C2.EQ.0.) GO TO 9
      IF(ALPHA.EQ.0.) GO TO 12
      A4=XONEW/A1
      GO TO 10
 12   IF(Y1NEW.EQ.YONEW) GO TO 11
      IF(THETAP.EQ.90.0.OR.THETAP.EQ.270.) GO TO 26
      IF(A.EQ.0.) GO TO 13
 56   PWINT=Y1+X1/A
 29   WINDIN =YO-A*XO
      XPERP=A*(PWINT-WINDIN )/(A*A+1.)
      YPERP=A*XPERP+WINDIN
      C1=XPERP-XO
      C2=YPERP-YO
      IF(Y1NEW.NE.YONEW) GO TO 51
 30   A4=Y2NEW
      GO TO 10
 51   IF(ALPHA.NE.0.) GO TO 52
      A4=Y1NEW
      GO TO 10
 52   A4=XONEW/A1-Y1NEW*A2
      GO TO 10
 26   C1=0.
      C2=Y1-YO
      GO TO 51
 13   C1=X1-XO
      C2=0.
      GO TO 51
 11   IF(THETAP.EQ.90.0.OR.THETAP.EQ.270.) GO TO 27
      IF(A.EQ.0.) GO TO 28
      PWINT=Y2+X2/A
      GO TO 29
 27   C1=0.
      C2=Y2-YO
      GO TO 30
 28   C1=X2-XO
      C2=0.
 9     IF(ALPHA.NE.0.) GO TO 56
       C1=X1-XO
       C2=Y1-YO
       A4=Y1NEW
C
C      GO AHEAD WITH SIGN CHECK
 10    IF(THETAP.EQ.90.) GO TO 20
       IF(THETAP.EQ.270.) GO TO 24
       IF(A.GE.0.0.AND.A.LT.1.0E38) GO TO 101
       IF(THETAP.GT.90.0.AND.THETAP.LE.185.) GO TO 22
       KK=1
       LL=-1
       GO TO 42
 22    KK=-1
       LL=1
       GO TO 42
 101   IF(THETAP.GT.0.0.AND.THETAP.LE.95.) GO TO 20
 24    KK=-1
       LL=-1
       GO TO 42
 20    KK=1
       LL=1
C
C      IF POINT IS DOWNWIND OF RECEPTOR, CHANGE SIGN OF A4 SO THAT A4 S
C      OF THE SAME SIGN WILL CONTRIBUTE TO CONCENTRATION
 42    IF(C1*KK.LT.0.0.AND.C2*LL.LT.0.) A4=-A4
       RETURN
C**  THIS PROGRAM VALID ON FTN4 AND FTN5 **
       END
```

Appendix B

THE MODAL EMISSION MODEL

This Appendix describes the modifications and additions made to the modal emission model supplied by the EPA. It provides the user with the information needed to modify the modal emission model of APRAC-3 based on updates by the EPA, provided that the EPA does not change the basic formulation of the model.

This Appendix describes in some detail the changes that were made. In the event that new versions of the emission model are radically altered by the EPA, sufficient information on the process by which the current emission model was changed for APRAC-3 is included to allow users to follow the process and extend it to new, different versions.

1. Background

The "Automobile Exhaust Emission Modal Analysis Model" (Kunselman, et al, 1974) calculates total emissions over a user-specified driving sequence defined by second-by-second speed data. The instantaneous emissions for each one-second time interval are computed from a polynomial fit to motor vehicle test data given by

$$\dot{e}(v,a) = b_1 + b_2\,v + b_3a + b_4\,av + b_5\,v^2 + b_6\,a^2 + b_7\,va^2 + b_8\,av^2 + b_9\,a^2\,v^2 \qquad \text{(B-1)}$$

when there is a speed change during the time interval, and by

$$\dot{e}(v,o) = b_{10} + b_{11}v + b_{12}v^2 \qquad \text{(B-2)}$$

when steady-speed driving occurs.* In Eqs. (B-1) and (B-2),

$\dot{e}$ = instantaneous emission rate, gm/s,

v = average speed during the time interval, mph,

---

*Strictly, there is a ramp function that provides for a smooth transition from acceleration to steady state by combining both equations when acceleration is between -1.2 and +1.0 mph/s.

a = acceleration (positive or negative) during the time interval, mph/s.

b_1-b_{12} = coefficients derived from fitting test data.

This formulation is cumbersome for developing emissions during acceleration sequences, as required by the intersection model of APRAC-3, since it calls for second-by-second speed data to be input. For the present application, Eq. B-1 has been made a function of acceleration and time, and integrated with respect to time to yield the emissions during acceleration in one calculation that depends on constant acceleration, and on time, which in turn is a function of initial speed, target speed, and acceleration.

Speed is always positive in the modal emission model, and this must be preserved in the integration to ensure that the individual terms are added or subtracted as they are in the instantaneous formulation. Since speed may be written as $v = at$, and since t is always positive, we may ensure positive speed by writing $v = a^2 t$. Substituting in Eq. (B-1) gives

$$e(a,t) = b_1 + b_2\sqrt{a^2}\, t + b_3 a + b_4 a\sqrt{a^2}\, t + b_5(\sqrt{a^2})^2\, t^2 + b_6 a^2 + b_7 a^2\sqrt{a^2}\, t + b_8 a(\sqrt{a^2})^2\, t^2 + b_9 a^2(\sqrt{a^2})^2\, t^2 \qquad \text{(B-3)}$$

Integrating over time and retaining the absolute value of a only in those terms that are odd functions of v, we have

$$e(a,t) = b_1 t + b_2\sqrt{a^2}\, t^2/2 + b_3 at + b_4 a\sqrt{a^2}\, t^2/2 + b_5 a^2 t^3/3 + b_6 a^2 t + b_7 a^2\sqrt{a^2}\, t^2/2 + b_8 a^3 t^3/3 + b_9 a^4 t^3/3\ . \qquad \text{(B-4)}$$

Similarly, Eq. (B-2) may be rewritten and integrated to yield

$$e = b_{10} t + b_{11}\sqrt{a^2}\, t^2/2 + b_{12} a^2 t^3/3. \qquad \text{(B-5)}$$

Finally, note that the value of t in Eqs. (B-4) and (B-5) is given by

$$t = (v_{final} - v_{initial})/a\ . \qquad \text{(B-6)}$$

As provided by the EPA, the modal emission model will calculate emissions of HC, CO_2, and NO_x, as well as fuel use, through different coefficients, b_i. Coefficients are provided for eighteen model year groupings, as shown in Table B-1, for a total of twelve coefficients for each of four pollutants for each of eighteen model year groupings. Finally, deterioration factors are provided so that all emissions may be computed for a 1975 calendar year.

A number of steps must be accomplished to make the modal emission model generally applicable to the intersection model of APRAC-3:

- The model groupings must be expanded internally to include the missing California and high-altitude model years for 1975 and earlier.
- Deterioration factors must be supplied for these additional model years and locations.
- The model groupings must be expanded to include years later than 1975 for all locations.
- For calendar years later than 1975, deterioration factors must be supplied for these additional model years and locations, as well as for 1975 and earlier model years.
- The model outputs must be made compatible with MOBILE1 so that the corrections for temperature, cold start, air conditioning, and vehicle type mix may be applied.

2. Inclusion of 1875 and Earlier California and High-Altitude Groups

The modal emission model is the basis for the speed correction factor calculations in MOBILE1; MOBILE1 also uses eighteen model groups. This is important because it identifies, by group, the modal behavior of emissions from vehicles by model year and location. Table B-2 indicates the MOBILE1 groups. Using this as a guide, Table B-3 shows the expanded groups for the modal emission model, where the underlined groups are those used in the same fashion as in MOBILE1. For example, modal emissions from a 1970 California vehicle are assumed to behave the same as a 1970 low-altitude vehicle in MOBILE1, and both vehicles are provided the same group designation (for seclection of the b_i coefficients) for the modal emission model.

Table B-1

MODAL EMISSION MODEL VEHICLE GROUP DESIGNATIONS

Model Year	Low Altitude	California	High Altitude
< 65	2	2	1
66	2	3	1
67	2	3	1
68	4	--	8
69	5	--	9
70	6	--	10
71	7	--	11
72	16	14	12
73	17	15	13
74	17	15	13
75	18	--	--

Table B-2

MOBILE1 VEHICLE GROUP DESIGNATIONS

Model Year	Low Altitude	California	High Altitude
≤ 65	2	2	1
66	2	3	1
67	2	3	1
68	4	4	8
69	5	5	9
70	6	6	10
71	7	7	11
72	14	13	12
73	17	16	15
74	17	16	15
≥ 75	18	18	18

Table B-3

EXPANDED MODAL EMISSION MODEL VEHICLE GROUP DESIGNATIONS PATTERNED AFTER MOBILE1

Model Year	Low Altitude	California	High Altitude
≤ 65	2	2	1
66	2	3	1
67	2	3	1
68	4	4	8
69	5	5	9
70	6	6	10
71	7	7	11
72	16	14	12
73	17	15	13
74	17	15	13
≥ 75	18	18	18

The assumption is that the modal behavior is similar but that the absolute values may differ. In the example, a factor must be applied to the group 4 emissions for California locations. This factor, contained in the program as array SMODAT, is found from the ratio of a 1970 California vehicle's emissions to those of a 1970 low-altitude vehicle, where both emissions are taken at the test date mileage used to build the modal b_i coefficients. In this case, the mileage was 28,700 miles. The test date mileages for the expanded California and high-altitude groups are contained in the program in the variable MILES. The emissions at the test date mileage are calculated using the coefficients and method explained in Tables I-1, CAL-I-1, and HI-I-1 of Mobile Source Emission Factors (EPA, 1978)

3. Deterioration Factors to Mid-1975

The EPA has supplied deterioration factors for the vehicle model year groups included in the model to calculate emissions in calendar year 1975. Deterioration factors must also be supplied for the expanded model groups from the step above. This is accomplished by the same method used by the EPA; that is, the deterioration factor is formed by the ratio of the vehicle's Federal Test Procedure (FTP) emissions for mileage in July of 1975, taken from the national averages supplied in Table I-5a of Mobile Source Emission Factors, to its emissions at the model group test date mileage. These factors are calculated in the APRAC-3 program and included with those supplied by the EPA in array DETER.

4. Inclusion of Post-1975 Model Years

Modal emissions of post-1975 model years, in the model year, are calculated by a procedure recommended by the EPA. First, the ratio of the mid-year FTP emissions of the post-1975 model year to the low-altitude, mid-year, 1975 model year FTP emissions is calculated using the emission slope and intercept (deterioration rate and new vehicle emission rate) data from MOBILE1. (For example, see Table I-1 of Mobile Source Emission Factors.) The factor, UPDATE, that is formed by this ratio is applied to the mid-year group 18 emissions calculated by the modal emission model to find the emissions of the later model year. The assumption inherent to this procedure is that the modal emission behavior of later model years is similar to that of group 18 (low altitude, 1975).

5. Deterioration to the Calendar Year of Interest

While the EPA supplied deterioration factors for most 1975 and earlier model years, and the rest were calculated as explained above, additional deterioration must be incorporated for these and post-1975 vehicles for the calendar year being modeled. Model years 1975 and earlier are deteriorated from 1975, and later model years are deteriorated from the model year to the calendar year of interest. This is accomplished by calculating the factor DEFAC. DEFAC is formed by the ratio of FTP emissions in the calendar year to FTP emissions in the model year for post-1975 vehicles. Earlier model years use a denominator of FTP emissions for the vehicle age in 1975, since the factor DETER has already deteriorated their emissions to that year.

6. Additional Corrections

The effects of temperature, cold starts, air conditioning, and vehicle type mix are incorporated into the modal emission estimates through factors passed from MOBILE1 and included in the array CORFAC. CORFAC is a correction factor formed by combining three individual correction factors: a temperature/cold-starts correction factor, an air-conditioning correction factor, and a correction factor for vehicle type mix.

The temperature/cold-starts correction factor is found by using the EPA-recommended procedure of forming a ratio of two FTP temperature/cold-starts/speed correction factors. The factor that forms the numerator of the ratio assumes the ambient temperature of the hour being modeled, the cold-start percentages associated with the intersection locale type, and a particular speed. The denominator of the ratio assumes a temperature of 75°F, 100 percent warm operation, and the same speed. Corrections factors are computed for various speeds.

The air-conditioning correction factor is computed using the ambient temperature of the hour being modeled. Since the modal model treats only light-duty vehicles, a correction factor that accounts for other vehicle types has been included. It consists of the ratio of the composite FTP emission factor to the FTP LDV emission factor for the ambient temperature of the hour being modeled and the cold-start percentages associated with the intersection locale type for each of several speeds.

Appendix C

DETAILED DESCRIPTION OF INPUTS REQUIRED BY THE INTERSECTION MODEL

1. Introduction

The intersection model theory was discussed in Section II-D-3-b of the body of this manual, as were the inputs required. However, those inputs are sufficiently complicated that this appendix has been added to provide the user who might be unfamiliar with traffic modeling with a better understanding of the requirements. The following section gives a detailed description of the individual inputs used in the model.

2. Inputs

a. Traffic Volumes

Table C-1 gives a more detailed description of the inputs specified in the text as D-15a and D-15b.

The volume of vehicles (VOL) approaching the intersection must be specified for each hour to be modeled. The number of vehicles turning left and right must also be specified because this has a large influence on the capacity of each approach. The number of vehicles making any turning movement may be specified either as the volume (veh/hr) making that movement or as a fraction of the total volume using the approach. Subsequent traffic volume data (VOL) are all entered in units of vehicles per hour for the hour of the calculation. If the flag is entered as 2, subsequent specifications of right- and left-turn volumes will be given in terms of the fraction of total vehicles entering the intersection that make these turns. The total number of vehicles entering the intersection during the hour is specified instead of the volume of nonturning traffic.

b. Platoons

As noted in the text (Section II-D-3-b), the model calculates the fraction of the cars that arrive at the intersection in platoons released from other signals upstream. The platoon fraction of the total arrivals from each direction can be input (PFRAC) if the information is available. However, the model will estimate these values if these inputs are left blank.

Table C-1

MICRO INTERSECTION MODEL INPUT DATA: CARDS

Input	Column	Format	Variable Name	Units	Value Limits	Typical Value	Description
D-15a	1-5	I5	IFLAG	--	1 to 2	2	Flag indicates that right and left turning entries are volume counts (IFLAG=1), or that right and left turning entries are in units of fraction of thru traffic (IFLAG=2).
	6-20	3F5.0	VOL(1,1)	veh/hr	0.01 to 99999	298.	Volume of vehicles approaching from the north of the intersection and traveling straight thru (IFLAG=1) or the total traveling straight, right and left (IFLAG=2).
			VOL(1,2)	veh/hr or fraction	0.01 to 99999	0.1	Volume of vehicles approaching from the north of the intersection and turning right (IFLAG=1) or fraction of vehicles approaching from the north and turning right (IFLAG=2).
			VOL(1,3)	veh/hr or fraction	0.01 to 99999	0.1	Volume of vehicles approaching from the north of the intersection and turning left (IFLAG=1) or fraction of vehicles approaching from the north and turning left (IFLAG=2).
	21-35	3F5.0	VOL(2,1)	veh/hr	0.01 to 99999	862.	Volumes from the east approach similarly defined as for the north approach above.
			VOL(2,2)	veh/hr or fraction		0.1	
			VOL(2,3)			0.1	
	36-50	3F5.0	VOL(3,1)	veh/hr	0.01 to 99999	823.	Volumes from the south approach similarly defined as for the north approach above.
			VOL(3,2)	veh/hr or fraction		0.1	
			VOL(3,3)				
	51-65	3F5.0	VOL(4,1)	veh/hr	0.01 to 99999	638.	Volumes from the west approach similarly defined as for the north approach above.
			VOL(4,2)	veh/hr or fraction		0.1	
			VOL(4,3)			0.1	

Table C-1 (continued)

Input	Column	Format	Variable Name	Units	Value Limits	Typical Value	Description		
D-15a	66-77	4F3.3	PFRAC(I)	fraction	0. - 1.0	0.8	The fraction of vehicles approaching as a platoon. If this value is zero, the program assumes a platoon size which is the same as generated by the intersection being modeled. The fraction applies to platoons arriving from the north, east, south, and west.		
D-15b	1-2	I2	ITYPC	--	1 to 5	2	Type control: 0 = no control; 1 = fixed time control with possible left turn phase; 2 = vehicle actuated (V/A) control with possible left turn phase; 3 V/A control with left and thru traffic moving on one phase; 4 = V/A control with the N-S approaches under type 2 control and the E-W approaches under type 2 control and the N-S approaches under type 3 control.		
	3-6	I4	ICYCL	sec	PH	60	Maximum signal cycle time		
							Type 1 Control, Phase Times	Type 2 Control, Minimum Phase Times	Type 3 Control, Minimum Phase Times
	7-10	F4.0	PH(1)	sec	≥0.	30.	N-S approaches	N-S approaches	N approaches
	11-14	F4.0	PH(2)	sec	≥0.	30.	E-W approaches	E-W approaches	E approaches
	15-18	F4.0	PH(3)	sec	≥0.	0.	N-S left turn approaches	N-S left turn approaches	S approaches
	19-22	F4.0	PH(4)	sec	≥0.	0.	E-W left turn approaches	E-W left turn approaches	W approaches
	23-26	F4.0	CI	sec	≥0.	3.	Amber time interval		
	27-30	F4.0	GCAP(1)	veh/hr of green	>0.	3600(1200 veh/hr/lane)	Capacity of a N-S approach for type 1, 2, and 4 control, or for the N approach for type 3 and 5 control		
	31-34	F4.0	GCAP(2)	veh/hr of green	≥0.	3600(1200 veh/hr/lane)	Capacity of an E-W approach for type 1, 2, and 5 control, or for the E approach for type 3 and 4 control.		
	35-38	F4.0	GCAP(3)	veh/hr of green	≥0.	0.(1200 veh/hr/lane)	Capacity of a N-S left turn approach for type 1, 2, and 4 control, or for the S approach for type 3 and 5 control.		
	39-42	F4.0	GCAP(4)	veh/hr of green	≥0.	0.(1200 veh/hr/lane)	Capacity of an E-W left turn approach for type 1, 2 and 5 control, or for the W approach for type 3 and 4 control.		

Table C-1 (continued)

Input	Column	Format	Variable Name	Units	Value Limits	Typical Value	Description
	43-46	F4.0	RELART(1)	sec	-200. to 200.	0.1	Time of arrival of a platoon of vehicles relative to the start of green phase, on the north approach for thru vehicles.
	47-58	3F4.0	RELART(2)	sec	-200. to 200.	-10.	Relative time of arrival of a platoon on the east, south, and west approaches.
			RELART(3)	sec	-200. to 200.	20.	
			RELART(4)	sec	-200. to 200.	25.	
	59-74	4I4	NAL(1)	--	0 to 9999	2	The number of approach lanes including turning channels on the north, east, south, and west approaches where there is a separate left turn phase, the number of lanes associated with this phase should be specified.
			NAL(2)	--	0 to 9999	2	
			NAL(3)	--	0 to 9999	2	
			NAL(4)	--	0 to 9999	2	

Often signal controllers in urban and suburban areas are interconnected, so that vehicles leaving one intersection will arrive at the downstream intersection while the signal is green. The offsets of such a signal system are available through the local traffic engineer. The offsets may be used along with the time it takes to travel from the upstream intersection, to determine the time at which the platoon of vehicles arrives at the intersection. The time (RELART, entered on input 15b) should be measured relative to the start of a green signal on the particular approach. For example, if the offset between two signals is 7 seconds and it takes 9 seconds to travel from the upstream intersection, then the relative platoon arrival time is 9-7 = 2 seconds. (For vehicles traveling to the upstream intersection, the relative arrival time is 9 + 7 = 16 sec). If a zero time is entered, the model will assume no interconnection or coordination exists. A positive or negative relative arrival time is legitimate.

A report is printed from Subroutine PLATON when the platoon option is selected on Input 15b. This report is in the following format:

```
DEBUG PLATOON

xxxxx    xxxxx    xxxxx    xxxxx    xxxxx    xxxxx    xxxxx    xxxxx   xxx  xxx
```

The printout is of variables useful in checking the performance of the PLATON subroutine and does not indicate an error condition. The two lines of printout occurs for each intersection approach for which platooning is in effect in the order 1) north approach 2) east approach 3) south approach 4) west approach.

There are 10 variables printed for each platooned approach, and these are identified in Table C-2.

c. Signal Timing and Control

Table C-1 gives the values of ITYPC that should be entered for the various possible signalized traffic control alternatives that the model will treat.

ITYPC may also be set equal to zero, which allows optional alternative inputs to be specified. These are discussed later in this appendix, in Section 2.f.

Table C-2

PRINTED OUTPUT GENERATED BY THE PLATOON OPTION

Variable	Symbol	Description
1	W1	Average delay per vehicle at signal (sec)
2	NS	Number of vehicles that stop during an hour (veh)
3	GP	Green phase time required to exhaust the queue built during the red phase (sec)
4	GR	Total delay caused by the queue formed during the red phase by platooned and non-platooned arrivals (veh-sec)
5	QR	Queue length at the end of the red phase (veh)
6	R	Red duration on the approach (sec)
7	SS	Saturation Flow rate (veh/sec)
8	Q1	Flow rate of non-platooned vehicles (veh/sec)
9	Q2	Flow rate of platooned vehicles (veh/sec)
10	T2	Green phase length on an approach (sec)

It is quite important that signal timing be specified as realistically as possible. When an existing intersection is being modeled, the local city traffic engineer will know the timing of the signal. When the signal timing is not readily available, an optimum timing can be computer-generated by specifying vehicle-actuated signal control.

Signal timing parameters are cycle time, phase times, and amber time. The cycle time (ICYCL) is the time required for a signal to proceed through all signal indications. For a fixed-time signal, cycle time is the sum of the phase times. When a vehicle-actuated signal controller is specified, the maximum cycle time must be specified. This will place an upper limit on the cycle time, but a shorter, more nearly optimum cycle time will be selected by the computer program.

Phase times (PH) are those times during which a green or amber indication is given to one or more directions of flow. A typical phase controls through, through and left, or left turning vehicles at an intersection approach or approaches.

If a signal controller is fixed-time, the phase times are specified by the user. If a signal controller is vehicle-actuated, minimum phase times are specified by the user and the computer program selects optimum times for each phase. A typical fixed-time controller might have two phases of 30 seconds each. The signal would indicate green or amber for 30 seconds to the north and south intersection approaches, and then would indicate green or amber for 30 seconds to the east and west intersection approaches.

A typical vehicle-actuated controller might have two phases of a minimum of 20 seconds each. This controller could indicate green or amber to the north and south intersection approaches of between 20 seconds and one cycle length minus 20 seconds. As many as four phases may be specified for an intersection, using the input format. The user specifies a phase time in any of four locations on an input card; a zero phase time indicates the phase is not active and is to be skipped.

The yellow or amber time (CI) is assumed constant for all intersection approaches. Amber time influences the amount of time during which vehicles proceed, the assumption being that vehicles proceed if arriving in the first half of the amber interval, but stop if arriving in the second half of the amber interval.

d. Capacity

Capacity service volume (GCAP) is the number of vehicles that can proceed through an intersection from one approach during one hour of green-light time. Two charts for estimating the capacity of an intersection approach per hour of green-light time are presented as Figures C-1 and C-2. The user should determine a capacity service volume for each intersection approach from the appropriate chart and enter it directly in the space provided on the data card. The user must know the width of the intersection approach, the approximate size of the metropolitan area, and whether the intersection is in the central business district (CBD), outlying business district (OBD), fringes, or residential area. Adjustments are made for left and right turning vehicles within the computer program. In addition, the user may need to adjust capacity service volume for trucks and buses. If this is required, the user may refer to the Highway Capacity Manual (1965) for adjustment factors.

An approach width (WA), which is used to enter each chart, is the distance from the curb to the center line for a two-way street and the distance from curb to curb for a one-way street.

e. Number of Approach Lanes

Approach lanes include all through lanes, turning lanes, and turning channels (NAL). In general, a lane is from 10 to 12 feet wide. If only the approach width is known, a good guess at the number of lanes can be made, and used to estimate approach width for the capacity calculation.

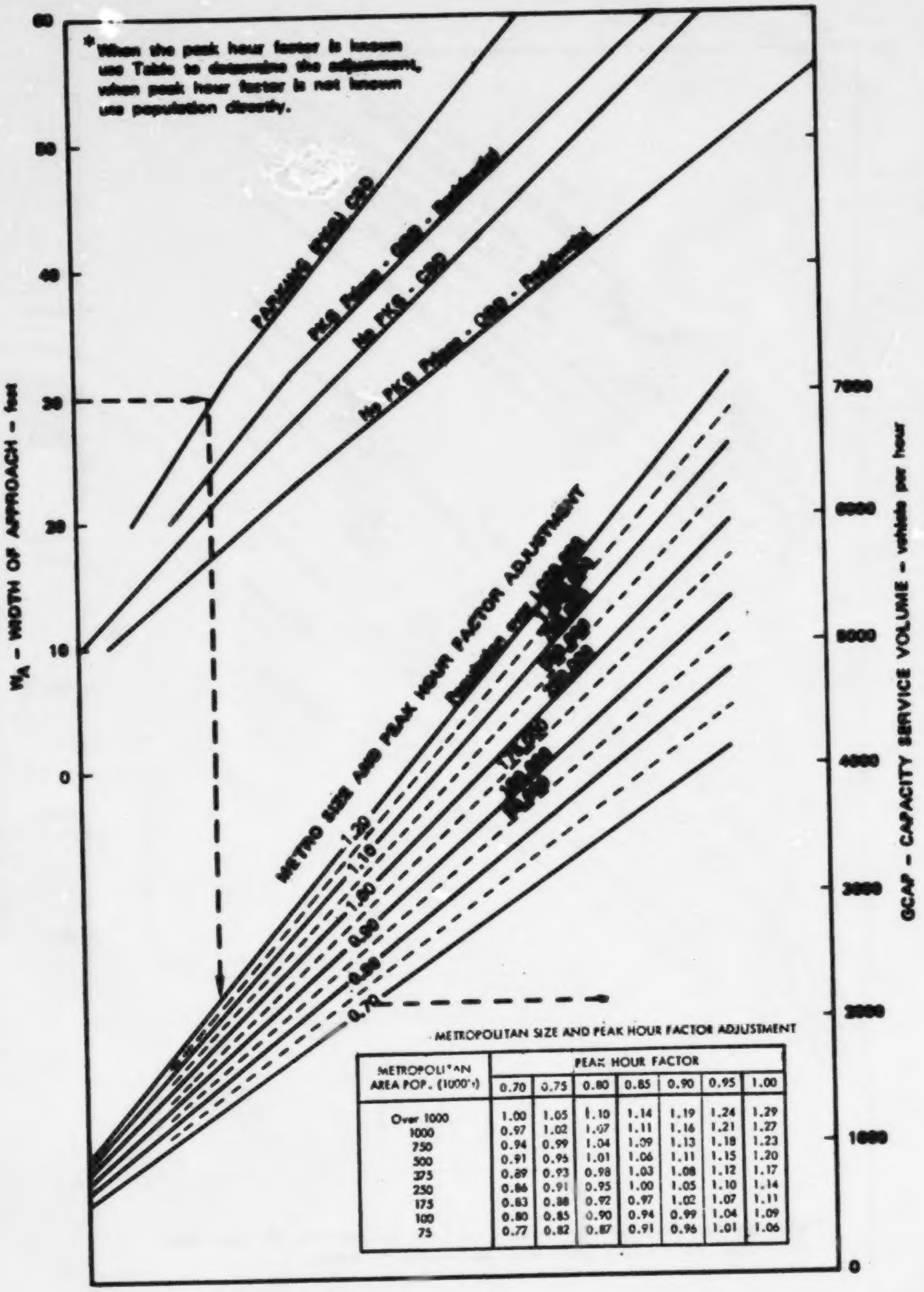
f. Optional Inputs

1) Background

When ITYPC is set equal to zero, certain optional inputs can be made. This option allows the user to calculate delays and queue lengths and enter them directly into the program for use in computing emissions and modeling the diffusion. Table C-3 presents the meaning of these alternative inputs when ITYPC is set equal to zero. Their meaning is discussed below.

2) Delay

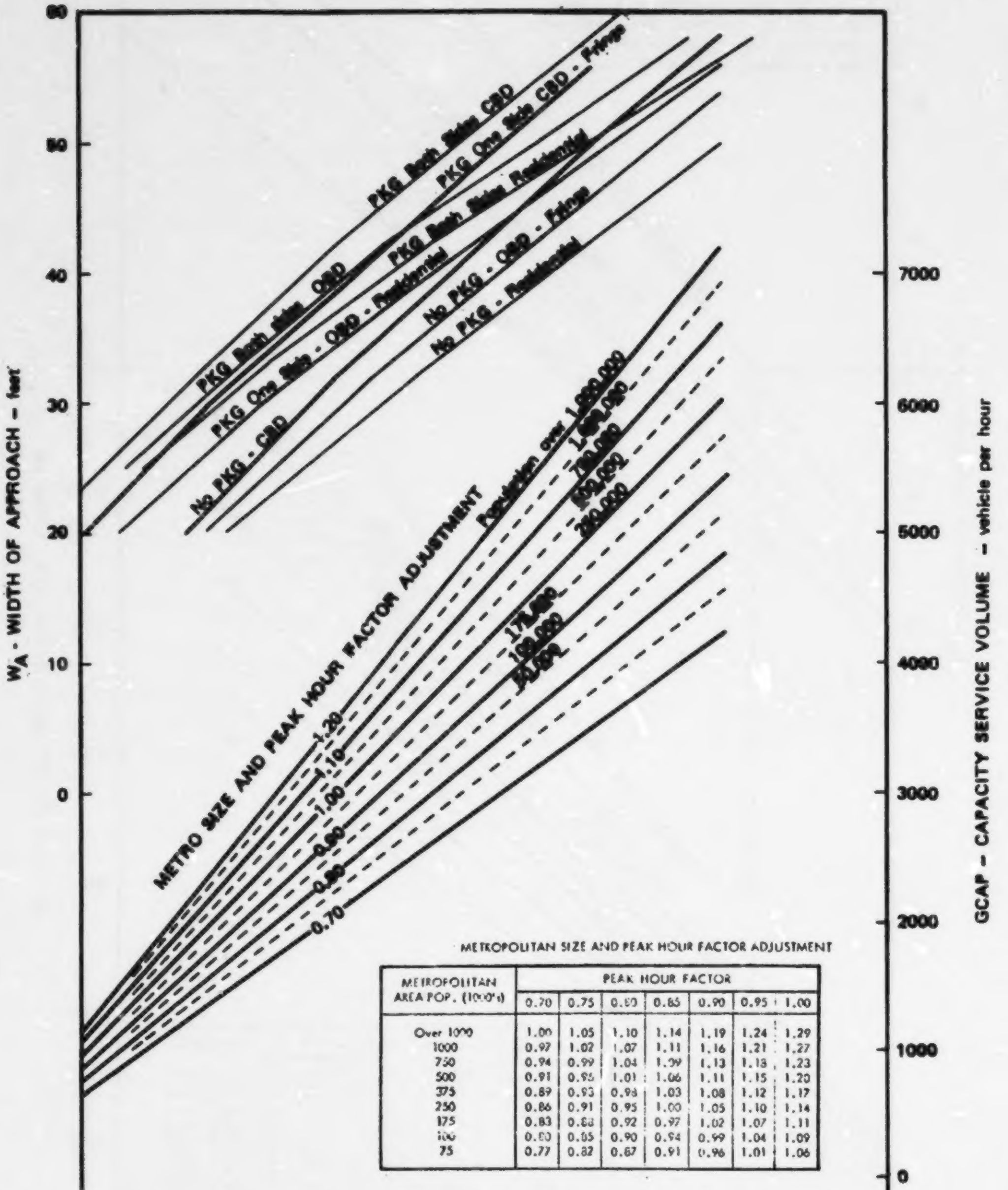
An average delay per vehicle (DELAI) may be calculated by the user and input to the program in cases where an unusual configuration exists. Delay is sometimes available from a local traffic engineer, or



METROPOLITAN SIZE AND PEAK HOUR FACTOR ADJUSTMENT

METROPOLITAN AREA POP. (1000's)	PEAK HOUR FACTOR						
	0.70	0.75	0.80	0.85	0.90	0.95	1.00
Over 1000	1.00	1.05	1.10	1.14	1.19	1.24	1.29
1000	0.97	1.02	1.07	1.11	1.16	1.21	1.27
750	0.94	0.99	1.04	1.09	1.13	1.18	1.23
500	0.91	0.96	1.01	1.06	1.11	1.15	1.20
375	0.89	0.93	0.98	1.03	1.08	1.12	1.17
250	0.86	0.91	0.95	1.00	1.05	1.10	1.14
175	0.83	0.88	0.92	0.97	1.02	1.07	1.11
100	0.80	0.85	0.90	0.94	0.99	1.04	1.09
75	0.77	0.82	0.87	0.91	0.96	1.01	1.06

FIGURE C-1. TWO WAY STREET CBD, FRINGE, OBD AND RESIDENTIAL CAPACITIES



METROPOLITAN SIZE AND PEAK HOUR FACTOR ADJUSTMENT

METROPOLITAN AREA POP. (1000's)	PEAK HOUR FACTOR						
	0.70	0.75	0.80	0.85	0.90	0.95	1.00
Over 1000	1.00	1.05	1.10	1.14	1.19	1.24	1.29
1000	0.97	1.02	1.07	1.11	1.16	1.21	1.27
750	0.94	0.99	1.04	1.09	1.13	1.18	1.23
500	0.91	0.96	1.01	1.06	1.11	1.15	1.20
375	0.89	0.93	0.98	1.03	1.08	1.12	1.17
250	0.86	0.91	0.95	1.00	1.05	1.10	1.14
175	0.83	0.88	0.92	0.97	1.02	1.07	1.11
100	0.80	0.85	0.90	0.94	0.99	1.04	1.09
75	0.77	0.82	0.87	0.91	0.96	1.01	1.06

* When the peak hour factor is known , use Table to determine the adjustment, when peak hour factor is not known use population directly.

FIGURE C-2. ONE WAY STREET CBD, FRINGE, OBD AND RESIDENTIAL CAPACITIES

Table C-3

ALTERNATE INTERSECTION INPUTS WHEN ITYPC=0

Input	Column	Format	Variable Name	Units	Value Limits	Typical Value	Description
15b	1-2	I2	ITYPC	Number	0	0	Numbers indicating delay, queue and number of stops on each approach will be read from this card rather than computed when ITYPC=0.
	3-6	I4	ICYCL	sec	0 to 9999	60	The length of a complete signal cycle.
	7-22	4F4.0	DELAT(1)	sec	0. to 9999	8.0	The average delay experienced by vehicles on the north, east, south, and west approaches.
			DELAT(2)	sec	0. to 9999	11.	
			DELAT(3)	sec	0. to 9999	10.	
			DELAT(4)	sec	0. to 9999	8.	
	27-42	4F4.0	QEX(1)	veh/cycle	0. to 9999	3.	The maximum extension of the queue in vehicles per signal.
			QEX(2)	veh/cycle	0. to 9999	10.	
			QEX(3)	veh/cycle	0. to 9999	9.	
			QEX(4)	veh/cycle	0. to 9999	7.	
	59-74	4I4	NAL(1)	--	0 to 9999	2	The number of approach lanes including turning channels on the north, east, south, and west approaches
			NAL(2)	--	0 to 9999	2	
			NAL(3)	--	0 to 9999	2	
			NAL(4)	--	0 to 9999	2	

may be calculated using Webster's, Newell's or other intersection modeling techniques. A graphic solution is presented in Figure C-3. The graphs in Figure C-3 can be used to estimate the necessary inputs.

3) Queue Length

An estimate of the maximum extension of the queue (QEX, veh/cycle) must be input if the delay is hand calculated. The value is used to determine the length of the roadway in which vehicles accelerate, decelerate and idle, and the number of vehicles that stop. An equation for computing QEX is included here:

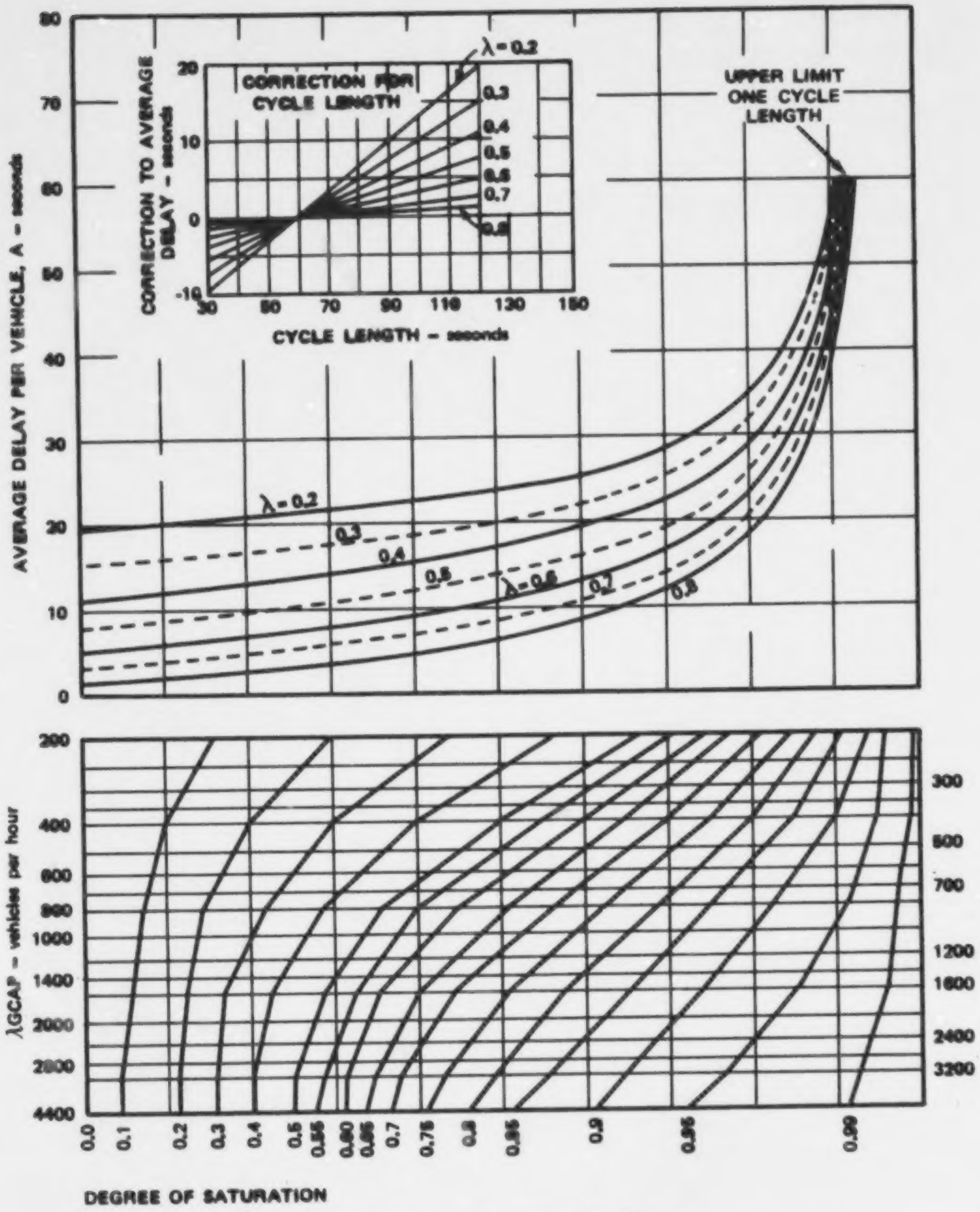
$$QEX = \frac{V \cdot Cy}{3600} \cdot \frac{(1 - \lambda)}{1 - V/GCAP} + \frac{V}{2(\lambda GCAP - V)} \qquad \text{(C-1)}$$

where V= demand volume

Cy= cycle time

λ= green to cycle time ratio

GCAP= saturation flow.



where: χ = V/λGCAP = V/capacity

V = demand volume

GCAP = saturation flow

λ = green to cycle time ratio

FIGURE C-3. INTERSECTION DELAY PER VEHICLE

Appendix D

SAMPLE PROBLEMS

The following pages present the inputs and outputs for four sample problems. The inputs to the emissions preprocessor are presented first and are labeled. The corresponding preprocessor outputs follow. They are printed side-reading on the page. The inputs and then the outputs of APRAC-3 (the main model) follow the preprocessor data for each problem. Note that the preprocessor output for Problem 3 is also used for Problem 4. Also, the traffic tape inputs (from program COMSIS) listed for Problem 3 are also used in Problem 4.

The Units used are generally presented in the outputs. The user should note that the units used in presenting concentrations are different for the different pollutants. They are as follows:

Hydrocarbons--10-μg m^{-3}

Carbon monoxide--100-μg m^{-3}

Oxides of Nitrogen--μg m^{-3}

The intermediate results of the intersection modeling are presented when that option is exercised.

One further comment is in order. These are sample problems. The inputs do not necessarily represent realistic cases for the user's own area. The user should always make the effort to obtain inputs appropriate to the area being studied. Also, different storage options are used in the CDC versus IBM and UNIVAC versions of the program. The results presented here were run on a CDC computer. Results from an IBM or UNIVAC computer may differ slightly.

```
                          EMISSIONS PREPROCESSOR INPUTS:  PROBLEM 1
CARD        10        20        30        40        50        60        70        80
 NO..........+.........+.........+.........+.........+.........+.........+.........+
  1 QISMAP
  2 INSPEC                                            NO
  3 USRNYM/R                                          NO
  4 USRMIX                                            NO        NO
  5 REGION                                            NO
  6 CY                                                LOW
  7 QPOL                                              1980
  8 KHRI.NHRSIM                                       YES       NO        NO
  9 80.       76.       71.       68.       64.       18         5
```

EMISSIONS PREPROCESSOR OUTPUTS: PROBLEM 1

```
        HOUR =   18      TEMP =  80.0

      HC  COMPOSITE EMISSION FACTORS

                LOCALE/FACILITY TYPE:
SPEED      1        2        3        4        5        6
-----   ------   ------   ------   ------   ------   ------
  5.0    26.57    25.15    29.07    31.77    30.42    34.14
  5.0    26.57    25.15    29.07    31.77    30.42    34.14
  7.5    22.59    21.58    24.36    27.97    27.02    29.65
 10.5    20.16    19.42    21.46    25.65    24.96    26.89
 13.5    18.86    18.27    19.90    24.42    23.86    25.41
 16.5    18.08    17.58    18.97    23.67    23.20    24.52
 19.5    17.55    17.11    18.35    23.18    22.75    23.93
 22.5    17.16    16.75    17.90    22.80    22.41    23.50
 25.5    16.84    16.45    17.53    22.50    22.13    23.15
 28.5    16.56    16.20    17.22    22.23    21.89    22.85
 31.5    16.32    15.98    16.95    22.01    21.68    22.60
 34.5    16.12    15.79    16.72    21.81    21.51    22.38
 37.5    15.96    15.64    16.53    21.66    21.37    22.20
 40.5    15.83    15.53    16.38    21.54    21.26    22.06
 43.5    15.74    15.45    16.28    21.45    21.18    21.96
 46.5    15.68    15.40    16.21    21.40    21.13    21.89
 49.5    15.64    15.36    16.16    21.36    21.10    21.84
 52.5    15.60    15.32    16.12    21.32    21.06    21.80
 55.5    15.53    15.25    16.05    21.25    20.99    21.74
 58.5    15.39    15.12    15.91    21.13    20.87    21.61
```

```
                    HOUR =   19     TEMP =  76.0

               HC  COMPOSITE EMISSION FACTORS

                    LOCALE/FACILITY TYPE:
SPEED        1        2        3        4        5        6
-----     ------   ------   ------   ------   ------   ------
  5.0     26.81    25.27    29.55    31.99    30.53    34.59
  5.0     26.81    25.27    29.55    31.99    30.53    34.59
  7.5     22.75    21.66    24.69    28.12    27.10    29.97
 10.5     20.28    19.48    21.70    25.77    25.01    27.12
 13.5     18.95    18.32    20.10    24.51    23.91    25.59
 16.5     18.16    17.62    19.14    23.75    23.24    24.68
 19.5     17.63    17.14    18.50    23.24    22.79    24.07
 22.5     17.23    16.78    18.03    22.86    22.44    23.62
 25.5     16.90    16.48    17.65    22.55    22.16    23.26
 28.5     16.62    16.23    17.33    22.29    21.92    22.96
 31.5     16.37    16.00    17.05    22.05    21.71    22.69
 34.5     16.17    15.82    16.82    21.86    21.53    22.47
 37.5     16.00    15.66    16.62    21.70    21.39    22.28
 40.5     15.87    15.55    16.47    21.58    21.28    22.14
 43.5     15.78    15.47    16.36    21.49    21.20    22.04
 46.5     15.72    15.42    16.29    21.43    21.15    21.97
 49.5     15.68    15.38    16.24    21.40    21.11    21.92
 52.5     15.64    15.34    16.20    21.36    21.08    21.88
 55.5     15.57    15.27    16.12    21.29    21.01    21.81
 58.5     15.43    15.14    15.98    21.16    20.89    21.68
```

```
                    HOUR =    20      TEMP =  71.0

                 HC  COMPOSITE EMISSION FACTCRS

                    LOCALE/FACILITY TYPE:
SPEED         1         2         3         4         5         6
-----      ------    ------    ------    ------    ------    ------
  5.0       27.13     25.43     30.20     32.29     30.69     35.21
  5.0       27.13     25.43     30.20     32.29     30.69     35.21
  7.5       22.97     21.77     25.15     28.34     27.20     30.40
 10.5       20.44     19.56     22.03     25.92     25.09     27.44
 13.5       19.08     18.38     20.36     24.63     23.97     25.84
 16.5       18.27     17.67     19.36     23.86     23.29     24.89
 19.5       17.72     17.19     18.70     23.34     22.83     24.26
 22.5       17.31     16.82     18.21     22.95     22.49     23.79
 25.5       16.98     16.52     17.82     22.63     22.20     23.42
 28.5       16.69     16.26     17.48     22.36     21.95     23.10
 31.5       16.44     16.04     17.19     22.12     21.74     22.83
 34.5       16.23     15.85     16.95     21.92     21.56     22.59
 37.5       16.06     15.70     16.74     21.76     21.42     22.40
 40.5       15.93     15.58     16.59     21.63     21.30     22.25
 43.5       15.84     15.50     16.47     21.54     21.23     22.14
 46.5       15.77     15.44     16.40     21.49     21.18     22.07
 49.5       15.73     15.41     16.35     21.45     21.14     22.02
 52.5       15.69     15.37     16.30     21.41     21.10     21.98
 55.5       15.62     15.29     16.23     21.34     21.04     21.91
 58.5       15.48     15.16     16.08     21.21     20.91     21.77
```

```
                HOUR =   21     TEMP =  68.0

           HC  COMPOSITE EMISSION FACTORS


                    LOCALE/FACILITY TYPE:
SPEED        1        2        3        4        5        6
-----     ------   ------   ------   ------   ------   ------
  5.0     27.34    25.54    30.62    32.49    30.78    35.61
  5.0     27.34    25.54    30.62    32.49    30.78    35.61
  7.5     23.12    21.85    25.44    28.47    27.27    30.68
 10.5     20.54    19.61    22.25    26.02    25.14    27.64
 13.5     19.17    18.42    20.53    24.71    24.01    26.00
 16.5     18.34    17.71    19.51    23.92    23.32    25.03
 19.5     17.79    17.22    18.83    23.40    22.86    24.38
 22.5     17.37    16.85    18.32    23.00    22.51    23.90
 25.5     17.03    16.55    17.92    22.68    22.22    23.52
 28.5     16.74    16.29    17.58    22.40    21.98    23.20
 31.5     16.49    16.06    17.28    22.16    21.76    22.91
 34.5     16.27    15.87    17.03    21.96    21.58    22.67
 37.5     16.10    15.72    16.82    21.80    21.43    22.48
 40.5     15.97    15.60    16.66    21.67    21.32    22.32
 43.5     15.87    15.52    16.55    21.58    21.24    22.21
 46.5     15.81    15.46    16.47    21.52    21.19    22.14
 49.5     15.77    15.42    16.42    21.48    21.16    22.09
 52.5     15.72    15.38    16.37    21.44    21.12    22.05
 55.5     15.65    15.31    16.30    21.37    21.05    21.97
 58.5     15.51    15.18    16.15    21.24    20.93    21.83
```

```
                    HOUR =    22     TEMP =  64.0

               HC  COMPOSITE EMISSION FACTORS


                          LOCALE/FACILITY TYPE:
 SPEED        1        2        3        4        5        6
 -----     ------   ------   ------   ------   ------   ------
   5.0     27.63    25.68    31.22    32.77    30.92    36.18
   5.0     27.63    25.68    31.22    32.77    30.92    36.18
   7.5     23.32    21.95    25.86    28.67    27.37    31.07
  10.5     20.69    19.69    22.55    26.16    25.21    27.93
  13.5     19.29    18.48    20.78    24.82    24.06    26.24
  16.5     18.44    17.76    19.71    24.02    23.37    25.22
  19.5     17.88    17.27    19.01    23.48    22.91    24.55
  22.5     17.45    16.89    18.49    23.08    22.55    24.06
  25.5     17.11    16.59    18.07    22.75    22.26    23.66
  28.5     16.81    16.32    17.72    22.47    22.01    23.33
  31.5     16.55    16.09    17.41    22.22    21.79    23.04
  34.5     16.33    15.90    17.15    22.02    21.61    22.79
  37.5     16.16    15.74    16.94    21.85    21.46    22.59
  40.5     16.02    15.62    16.77    21.72    21.35    22.43
  43.5     15.92    15.54    16.65    21.63    21.27    22.31
  46.5     15.86    15.49    16.57    21.57    21.22    22.23
  49.5     15.82    15.45    16.52    21.53    21.18    22.18
  52.5     15.77    15.41    16.47    21.48    21.14    22.14
  55.5     15.70    15.33    16.39    21.41    21.07    22.07
  58.5     15.55    15.20    16.24    21.28    20.95    21.92
```

APRAC-3 INPUTS: PROBLEM 1

```
CARD        10        20        30        40        50        60        70        80
 NO.........+.........+.........+.........+.........+.........+.........+.........+
  1  1 PRINT INPUTS                                    YES
  2  2 PRINT GRIDDED  PRIMARY EMISSIONS                NO
  3  3 PRINT GRIDDED SECONDARY EMISSIONS               NO
  4  4 PRINT GRIDDED TOTAL EMISSIONS                   NO
  5  5 PRINT TRAFFIC LINK FILE                         NO        NO
  6  6 CALCULATE FOR HC-CO-NOX                         YES       NO        NO
  7  7 USE DIFFUSION MODEL                             YES
  8  8 2ND TRAF AUTO/BIG TRF/MINVMT                    NO   NO     000000.0     0
  9  9 USE CAPACITY RESTRAINT FOR SPEEDS               YES
 10 10 IS HOURLY VOLUME INPUT                          NO
 11 11 ARE TRAFFIC INPUTS IN FHWA FORMAT               NO
 12 12 ARE SPEEDS SPECIFIED FOR EACH LINK              NO
 13 13 AREA IDENTIFIER                                 STLOU
 14 14 ALTITUDE CATEGORY                               LO
 15 15 CALIF. CONTROLS                                 NO
 16 16 NO.E-W/N-S GRID SQUARES--GRID SIZE KM<           23        20        3.
 17 17 ORIGIN COORD. IN TRAFFIC SYSTEM<CONVER.FACTOR      00000.0   00000.0   0.01609
 18 0.015     0.008     0.006     0.004     0.004     0.007     0.027     0.061
 19 0.052     0.040     0.05      0.059     0.078     0.081     0.070     0.066
 20 0.077     0.072     0.049     0.043     0.047     0.036     0.026     0.021
 21 0.013     0.006     0.003     0.004     0.002     0.003     0.017     0.035
 22 0.036     0.039     0.048     0.067     0.104     0.068     0.070     0.071
 23 0.095     0.081     0.057     0.048     0.046     0.039     0.028     0.020
 24 0.008     0.004     0.003     0.002     0.002     0.007     0.036     0.101
 25 0.081     0.051     0.052     0.057     0.064     0.066     0.061     0.065
 26 0.068     0.052     0.052     0.052     0.045     0.028     0.025     0.018
 27 0.014     0.007     0.005     0.003     0.002     0.002     0.010     0.031
 28 0.041     0.038     0.046     0.055     0.068     0.06      0.064     0.073
 29 0.097     0.121     0.081     0.058     0.035     0.038     0.031     0.019
 30 0.006     0.003     0.002     0.002     0.003     0.015     0.078     0.149
 31 0.077     0.059     0.052     0.051     0.052     0.049     0.050     0.071
 32 0.056     0.052     0.055     0.043     0.021     0.017     0.017     0.011
 33 0.021     0.01      0.005     0.003     0.002     0.003     0.009     0.033
 34 0.036     0.034     0.04      0.053     0.056     0.060     0.063     0.074
 35 0.112     0.136     0.079     0.046     0.038     0.040     0.029     0.02
 36 0.01      0.004     0.004     0.002     0.005     0.018     0.066     0.103
 37 0.079     0.061     0.057     0.057     0.056     0.056     0.061     0.062
 38 0.079     0.065     0.054     0.031     0.019     0.018     0.016     0.016
 39 0.015     0.007     0.005     0.004     0.002     0.004     0.024     0.086
 40 0.057     0.049     0.051     0.053     0.057     0.064     0.067     0.074
 41 0.099     0.079     0.052     0.036     0.032     0.039     0.027     0.019
 42 0.007     0.002     0.002     0.001     0.001     0.012     0.056     0.161
 43 0.091     0.058     0.058     0.055     0.045     0.052     0.062     0.066
 44 0.064     0.059     0.054     0.032     0.017     0.012     0.019     0.015
 45 0.016     0.009     0.005     0.002     0.004     0.003     0.017     0.054
 46 0.046     0.037     0.051     0.052     0.048     0.051     0.057     0.073
 47 0.127     0.125     0.063     0.035     0.030     0.040     0.031     0.022
 48 0.014     0.007     0.004     0.004     0.006     0.016     0.062     0.097
 49 0.075     0.052     0.051     0.054     0.049     0.056     0.063     0.067
 50 0.072     0.064     0.047     0.039     0.027     0.027     0.026     0.022
 51 0.017     0.010     0.006     0.004     0.004     0.007     0.022     0.057
 52 0.055     0.044     0.044     0.050     0.057     0.053     0.059     0.078
 53 0.110     0.099     0.060     0.045     0.033     0.035     0.028     0.024
 54 0.013     0.004     0.004     0.002     0.003     0.005     0.033     0.127
 55 0.13      0.066     0.048     0.043     0.047     0.042     0.045     0.051
 56 0.07      0.073     0.056     0.042     0.031     0.026     0.020     0.017
 57 0.012     0.006     0.004     0.001     0.001     0.005     0.026     0.079
 58 0.086     0.049     0.039     0.040     0.043     0.046     0.052     0.071
 59 0.091     0.103     0.074     0.048     0.035     0.033     0.029     0.025
 60 0.007     0.003     0.002     0.001     0.0       0.009     0.077     0.175
```

```
CARD        10        20        30        40        50        60        70        80
 NO .........*.........*.........*.........*.........*.........*.........*.........*
 61 0.131     0.056     0.045     0.041     0.039     0.042     0.041     0.057
 62 0.059     0.059     0.045     0.032     0.023     0.021     0.023     0.013
 63 0.017     0.005     0.003     0.001     0.001     0.001     0.009     0.041
 64 0.049     0.034     0.032     0.034     0.035     0.035     0.043     0.070
 65 0.163     0.181     0.101     0.051     0.028     0.024     0.025     0.017
 66 0.009     0.006     0.004     0.003     0.005     0.011     0.055     0.094
 67 0.072     0.059     0.032     0.058     0.054     0.058     0.059     0.07
 68 0.083     0.068     0.051     0.039     0.033     0.034     0.023     0.018
 69 0.012     0.006     0.004     0.003     0.004     0.008     0.047     0.069
 70 0.053     0.052     0.055     0.056     0.052     0.061     0.063     0.073
 71 0.088     0.097     0.067     0.041     0.029     0.026     0.018     0.019
 72 0.011     0.006     0.005     0.004     0.007     0.023     0.110     0.117
 73 0.083     0.061     0.054     0.049     0.045     0.046     0.05      0.05
 74 0.065     0.058     0.042     0.037     0.021     0.019     0.021     0.017
 75 0.022     0.011     0.007     0.005     0.005     0.007     0.019     0.053
 76 0.045     0.045     0.045     0.047     0.043     0.05      0.053     0.07
 77 0.099     0.101     0.095     0.045     0.036     0.039     0.033     0.025
 78 0.012     0.004     0.0025    0.001     0.0005    0.0095    0.043     0.108
 79 0.09      0.045     0.0385    0.0375    0.037     0.0385    0.042     0.0635
 80 0.111     0.12      0.073     0.0425    0.0255    0.0225    0.024     0.015
 81 0.03      0.028     0.011     0.008     0.006     0.007     0.012     0.018
 82 0.024     0.033     0.034     0.041     0.042     0.041     0.038     0.037
 83 0.038     0.039     0.032     0.028     0.028     0.035     0.036     0.034
 84 0.03      0.028     0.011     0.008     0.006     0.007     0.012     0.018
 85 0.024     0.033     0.034     0.041     0.042     0.041     0.038     0.037
 86 0.038     0.039     0.032     0.028     0.028     0.035     0.036     0.034
 87 0.028     0.020     0.011     0.007     0.004     0.003     0.005     0.005
 88 0.01      0.011     0.014     0.02      0.023     0.023     0.025     0.025
 89 0.024     0.024     0.023     0.02      0.019     0.019     0.017     0.015
 90 0.01      0.011     0.014     0.02      0.023     0.023     0.025     0.025
 91 0.024     0.024     0.023     0.02      0.019     0.019     0.017     0.015
 92 0.028     0.020     0.011     0.007     0.004     0.003     0.005     0.005
 93 0.028     0.020     0.011     0.007     0.004     0.003     0.005     0.005
 94 0.01      0.011     0.014     0.02      0.023     0.023     0.025     0.025
 95 0.024     0.024     0.023     0.02      0.019     0.019     0.017     0.015
 96 0.028     0.020     0.011     0.007     0.004     0.003     0.005     0.005
 97 0.01      0.011     0.014     0.02      0.023     0.023     0.025     0.025
 98 0.024     0.024     0.023     0.02      0.019     0.019     0.017     0.015
 99    1.        1.        1.        1.
100      19.8
101 50.0    55.0    55.0    55.0    55.0    10.0    22.0    12.0    12.0    45.0
102   10000.  2500.
103      50.
104 1      25 25  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
105 2      25 25  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
106 2      25 25  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
107 4      25 25  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
108 5      25 25  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
109 5      25 25  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
110 7      25 25  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
111 7      25 25  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
112 9      25 25  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
113 10     25 25  0  0  0  0  0  0  0  0  0  0  0 30 40 50 60  0  0  0  0  0  0
114 11     25 25  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
115 12     25 25  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
116 13     25 25  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
117 14     25 25  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
118 15     25 25  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
119 15     25 25  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
120 17     25 25  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
121 18     25 25  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
122 19     25 25  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
123 20     25 25  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
124  0.        0.    609.    609.   150000.        2    1.         1   5000.
125 10.     10.    62.       62.     150000.        2    1.         1   5000.
126 1903.   1931.   1891.   1870.   240000.        2    1.         1   5000.
```

```
CARD          10         20         30         40         50         60         70         80
 NO.........*.........*.........*.........*.........*.........*.........*.........*
127 1888.    1945.    1869.    2004.    330000.
128 1976.    1948.    1920.    1979.     30000.          2        1.            1    5000.
129 1920.    1923.    1983.    1923.    120000.          2        1.            1    5000.
130 1893.    1869.    1924.    1923.    210000.          2        1.            1    5000.
131 1923.    1931.    1872.    1972.    300000.          2        1.            1    5000.
132 1926.    1926.    1926.    1988.    360000.          2        1.            1    5000.
133 1988.    1926.    2051.    1926.     90000.          2        1.            1    5000.
134 1891.    1912.    1953.    1912.    180000.          2        1.            1    5000.
135 1903.    1926.    1887.    1926.    270000.          2        1.            1    5000.
136 9                                                    2        1.            1    5000.
137 1980   1   7  12      20.      STOP
138 LAT.POP.CENTER CITY
139 NO. OF RECEPTORS                          38.6 2.36  31.5 40.5
140 XR/YR  1 31.   31.                          1
141 NO. OF WIND INPUTS
142 X.Y-W  1 32.0  33.0                         1
143 ST. CANYON/INTERSECTION          NO        NO
144 HOLIDAYS
145 1ST AND LAST HOUR
146 POLLUTANT                                   18   22
147 UPWIND BACKGROUND -NNE THRU S             HC
148 UPWIND BACKGROUND  SSW THRU N              600. 700. 500. 500. 400. 300. 250. 300.
149 DIRECT INPUT OF MIXING DEPTH               400. 450. 500. 200. 550. 450. 500. 500.
150 ST. LOUIS      800826   84   58           NO
151 03879710826120102 -    0158095001740    09930
152 03879710826120203 -    0183094002090    09890                 230002
153 03879710826120304 -    0215048002790    09810                 251002
154 03879710826120405 -    0226032003140    09770                 264003
155 03879710826120506 -    0219029005940    09460                 267003
156 03879710826120607 -    0154031015110    08500                 295005
157 03879710826120708 -    0097031022000    07830                 301007
158 03879710826120809 -    0076005027900    07290                 310011
159 03879710826120910 -    0055010031230    07000                 290014
160 03879710826121011 -    0020004039780    06300                 290017
161 03879710826121112 -    -095003058020    05000                 292017
162                0     0    68              0     0                 302017
163                1     0    66             27     4
164                2     0    66             26     4
165                3     0    65             33    16
166                4     0    64             27     4
167                5     0    61             27     4
168 710826         6     0    61     59      36    04
169 710826         7     0    65     60       3    05
170 710826         8     0    68     60       6    10
171 710826         9     0    72     59       9    05
172 710826        10     0    76     59      12    05
173 710826        11     0    79     59      15    05
174 710826        12     0    81     58      18    10
175 710826        13     1    82     59      21    13
176 710826        14     1    83     56      24    14
177 710826        15     1    84     54      27    14
178 710826        16     1    82     55      30    09
179 710826        17     0    80     56      33     5
180 710826        18     0    76     57      34    13
181 710826        19     0    71     56      36    10
182 710826        20     0    68     56      01    09
183 710826        21     0    64     56      02    08
184 710826        22     0    61     56      01    07
185 710826        23     0    60     56      36    07
186  ST LOUIS          800827    76     53
187 03879710827120102 -    0119097001740    09965
188 03879710827120203 -    0144096003230    09790                 350002
189 03879710827120304 -    0132073007750    09280                 011004
190 03879710827120405 -    0106084011920    08830                 012005
191 03879710827120506 -    0104054015100    08500                 347006
192 03879710827120607 -    0113030017190    08290                 331007
                                                                  327007
```

```
CARD         10        20        30        40        50        60        70        80
 NO..........+.........+.........+.........+.........+.........+.........+.........+
193 03879710827120708 -     0068020026370    07420             316010
194 03879710827120809 -     0075006027940    07280             313009
195 03879710827120910 -     0061009031160    07000             319008
196 03879710827121011 -     0050009036210    06580             329014
197 03879710827121112 -     0025008041820    06140             328019
198 03879710827121213 -    -037009049890    05550             332018
199 03879710827121314 -    -078006058060    05000             335020
```

```
200 710827    0    0   58    55   03   04
```

APRAC-3 OUTPUTS: PROBLEM 1

```
PRINT INPUTS- YES
PRIMARY, SECONDARY, AND/OR TOTAL TRAFFIC GRIDS TO BE PRINTED- NO,  NO,  NO
PRINT LINK FILE-BEFORE  NO
PRINT LINK FILE-AFTER  NO
POLLUTANTS TO BE CONSIDERED- HC, YES - CO, NO  - NOX, NO
DIFFUSION MODEL TO BE USED- YES
AUTOMATIC COMPUTATION OF SECONDARY TRAFFIC- NO
ONLY BIG LINKS CONSIDERED  NO
MINIMUM VOLUME INCLUDED            0.0
MAXIMUM LINKS INCLUDED  ,           0
SPEEDS FROM CAPACITY RESTRAINT-  YES
HOURLY TRAFFIC VOLUMES U SED (AS OPPOSED TO ADT) -NO
FHWA TRAFFIC- NO
SPEED SPECIFIED FOR NON-FHWA DATA- NO
AREA STLOU IS LO ALTITUDE---CALIF.= NO
  3.000-KM. SQ. GRIDS--  23 IN E-W DIRECTION AND 20 N-S
THE ORIGIN OF THE GRID SYSTEM IS       0.000,      0.000(0.01 MILE UNITS--TRAFFIC COORD. SYSTEM)
TO CONVERT 0.01-MILE TO KM., MULTIPLY BY    .016090

DIURNAL TRAFFIC CYCLES, PRIMARY--

 DIRECTION 1,LOCATION CODE = 1,FRACTION/HR    .0150   .0080   .0060   .0040   .0040   .0070   .0270   .0610
                                              .0520   .0400   .0500   .0590   .0780   .0810   .0700   .0660
                                              .0770   .0720   .0490   .0430   .0470   .0360   .0260   .0210

 DIRECTION 2,LOCATION CODE = 1,FRACTION/HR    .0130   .0060   .0030   .0040   .0020   .0030   .0170   .0350
                                              .0360   .0390   .0480   .0670   .1040   .0680   .0700   .0710
                                              .0950   .0810   .0570   .0480   .0460   .0390   .0280   .0200

 DIRECTION 1,LOCATION CODE = 2,FRACTION/HR    .0080   .0040   .0030   .0020   .0020   .0070   .0360   .1010
                                              .0810   .0510   .0520   .0570   .0640   .0660   .0610   .0650
                                              .0680   .0520   .0520   .0520   .0450   .0280   .0250   .0180

 DIRECTION 2,LOCATION CODE = 2,FRACTION/HR    .0140   .0070   .0050   .0030   .0020   .0020   .0100   .0310
                                              .0410   .0380   .0460   .0550   .0680   .0600   .0640   .0730
                                              .0970   .1210   .0810   .0580   .0350   .0380   .0310   .0190

 DIRECTION 1,LOCATION CODE = 3,FRACTION/HR    .0060   .0030   .0020   .0020   .0030   .0150   .0780   .1490
                                              .0770   .0590   .0520   .0510   .0520   .0490   .0500   .0710
                                              .0560   .0520   .0550   .0430   .0210   .0170   .0170   .0110

 DIRECTION 2,LOCATION CODE = 3,FRACTION/HR    .0210   .0100   .0050   .0030   .0020   .0030   .0090   .0330
                                              .0360   .0340   .0400   .0530   .0560   .0600   .0630   .0740
                                              .1120   .1360   .0790   .0460   .0380   .0400   .0290   .0200

 DIRECTION 1,LOCATION CODE = 4,FRACTION/HR    .0100   .0040   .0040   .0020   .0050   .0180   .0660   .1030
                                              .0790   .0610   .0570   .0570   .0560   .0560   .0610   .0620
                                              .0790   .0650   .0540   .0310   .0190   .0180   .0160   .0160

 DIRECTION 2,LOCATION CODE = 4,FRACTION/HR    .0150   .0070   .0050   .0040   .0020   .0040   .0240   .0860
                                              .0570   .0490   .0510   .0530   .0570   .0640   .0670   .0740
                                              .0990   .0790   .0520   .0360   .0320   .0390   .0270   .0190

 DIRECTION 1,LOCATION CODE = 5,FRACTION/HR    .0070   .0020   .0020   .0010   .0010   .0120   .0560   .1610
                                              .0910   .0580   .0580   .0550   .0450   .0520   .0620   .0660
                                              .0640   .0590   .0540   .0320   .0170   .0120   .0190   .0150

 DIRECTION 2,LOCATION CODE = 5,FRACTION/HR    .0160   .0090   .0050   .0020   .0040   .0030   .0170   .0540
                                              .0460   .0370   .0510   .0520   .0480   .0510   .0570   .0730
                                              .1270   .1250   .0630   .0350   .0300   .0400   .0310   .0220
```

```
DIRECTION 1.LOCATION CODE = 6.FRACTION/HR    .0140   .0070   .0040   .0040   .0060   .0160   .0620   .0970
                                             .0750   .0520   .0510   .0540   .0490   .0560   .0630   .0670
                                             .0720   .0640   .0470   .0390   .0270   .0270   .0260   .0220

DIRECTION 2.LOCATION CODE = 6.FRACTION/HR    .0170   .0100   .0060   .0040   .0040   .0070   .0220   .0570
                                             .0550   .0440   .0440   .0500   .0570   .0530   .0590   .0780
                                             .1100   .0590   .0600   .0450   .0330   .0350   .0280   .0240

DIRECTION 1.LOCATION CODE = 7.FRACTION/HR    .0130   .0040   .0040   .0020   .0030   .0050   .0330   .1270
                                             .1300   .0660   .0480   .0430   .0470   .0420   .0450   .0510
                                             .0700   .0730   .0560   .0420   .0310   .0260   .0200   .0170

DIRECTION 2.LOCATION CODE = 7.FRACTION/HR    .0120   .0060   .0040   .0010   .0010   .0050   .0260   .0790
                                             .0860   .0490   .0390   .0400   .0430   .0460   .0520   .0710
                                             .0910   .1030   .0740   .0480   .0350   .0330   .0290   .0250

DIRECTION 1.LOCATION CODE = 8.FRACTION/HR    .0070   .0030   .0020   .0010  0.0000   .0090   .0770   .1750
                                             .1310   .0560   .0450   .0410   .0390   .0420   .0410   .0570
                                             .0590   .0590   .0450   .0320   .0230   .0210   .0230   .0130

DIRECTION 2.LOCATION CODE = 8.FRACTION/HR    .0170   .0050   .0030   .0010   .0010   .0010   .0090   .0410
                                             .0490   .0340   .0320   .0340   .0350   .0350   .0430   .0700
                                             .1630   .1810   .1010   .0510   .0280   .0240   .0250   .0170

DIRECTION 1.LOCATION CODE = 9.FRACTION/HR    .0090   .0060   .0040   .0030   .0050   .0110   .0550   .0940
                                             .0720   .0590   .0320   .0580   .0540   .0580   .0590   .0700
                                             .0830   .0680   .0510   .0390   .0330   .0340   .0230   .0180

DIRECTION 2.LOCATION CODE = 9.FRACTION/HR    .0120   .0060   .0040   .0030   .0040   .0080   .0470   .0690
                                             .0530   .0520   .0550   .0560   .0520   .0610   .0630   .0730
                                             .0880   .0970   .0670   .0410   .0290   .0260   .0180   .0190

DIRECTION 1.LOCATION CODE =10.FRACTION/HR    .0110   .0060   .0050   .0040   .0070   .0230   .1100   .1170
                                             .0830   .0610   .0540   .0490   .0450   .0460   .0500   .0500
                                             .0650   .0580   .0420   .0370   .0210   .0190   .0210   .0170

DIRECTION 2.LOCATION CODE =10.FRACTION/HR    .0220   .0110   .0070   .0050   .0050   .0070   .0190   .0530
                                             .0450   .0450   .0450   .0470   .0430   .0500   .0530   .0700
                                             .0990   .1010   .0950   .0450   .0360   .0390   .0330   .0250

DIRECTION 1.LOCATION CODE =11.FRACTION/HR    .0120   .0040   .0025   .0010   .0005   .0095   .0430   .1080
                                             .0900   .0450   .0385   .0375   .0370   .0385   .0420   .0635
                                             .1110   .1200   .0730   .0425   .0255   .0225   .0240   .0150

DIRECTION 2.LOCATION CODE =11.FRACTION/HR    .0300   .0280   .0110   .0080   .0060   .0070   .0120   .0180
                                             .0240   .0330   .0340   .0410   .0420   .0410   .0380   .0370
                                             .0380   .0390   .0320   .0280   .0280   .0350   .0360   .0340

DIRECTION 1.LOCATION CODE =12.FRACTION/HR    .0300   .0280   .0110   .0080   .0060   .0070   .0120   .0180
                                             .0240   .0330   .0340   .0410   .0420   .0410   .0380   .0370
                                             .0380   .0390   .0320   .0280   .0280   .0350   .0360   .0340

DIRECTION 2.LOCATION CODE =12.FRACTION/HR    .0280   .0200   .0110   .0070   .0040   .0030   .0050   .0050
                                             .0100   .0110   .0140   .0200   .0230   .0230   .0250   .0250
                                             .0240   .0240   .0230   .0200   .0190   .0190   .0170   .0150
```

```
SECONDARY--WEEKDAY, SATURDAY, SUNDAY--
                                                   .0100   .0110   .0140   .0200   .0230   .0230   .0250   .0250
                                                   .0240   .0240   .0230   .0200   .0190   .0190   .0170   .0150
                                                   .0280   .0200   .0110   .0070   .0040   .0030   .0050   .0050

                                                   .0280   .0200   .0110   .0070   .0040   .0030   .0050   .0050
                                                   .0100   .0110   .0140   .0200   .0230   .0230   .0250   .0250
                                                   .0240   .0240   .0230   .0200   .0190   .0190   .0170   .0150

                                                   .0280   .0200   .0110   .0070   .0040   .0030   .0050   .0050
                                                   .0100   .0110   .0140   .0200   .0230   .0230   .0250   .0250
                                                   .0240   .0240   .0230   .0200   .0190   .0190   .0170   .0150

 SEASONAL ADJUSTMENTS (WINTER, SPRING, SUMMER, FALL)  1.0000  1.3000  1.3000  1.0000
AVG. SPEED (MPH) OF SECONDARY TRAFFIC =    19.800

 BASIC FREEWAY SPEEDS--5 LOCALES      50.0     55.0     55.0     55.0     55.0
   NON-FREEWAY SPEEDS--5-LOCALES      10.0     22.0     12.0     12.0     45.0

 HOURLY SPEED ADJUSTMENTS--

 DEFAULT CAPACITIES (VEHICLE/HR)--FREEWAY AND NON-FREEWAY,  10000.   2500.
 SECONDARY TRAFFIC=    50.0 PERCENT OF PRIMARY TRAFFIC.

 PERCENTAGES OF EACH GRID (ROWS LISTED S TO N, COLUMNS W TO E) OCCUPIED BY SEC. STREETS--

                                               0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
ROW  1   25. 25.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
ROW  2   25. 25.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
ROW  3   25. 25.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
ROW  4   25. 25.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
ROW  5   25. 25.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
ROW  6   25. 25.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
ROW  7   25. 25.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
ROW  8   25. 25.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
ROW  9   25. 25.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0. 30. 40. 50. 60.  0.  0.  0.  0.  0.
ROW 10   25. 25.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
ROW 11   25. 25.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
ROW 12   25. 25.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
ROW 13   25. 25.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
ROW 14   25. 25.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
ROW 15   25. 25.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
ROW 16   25. 25.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
ROW 17   25. 25.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
ROW 18   25. 25.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
ROW 19   25. 25.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
ROW 20   25. 25.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.

    LATITUDE = 38.6 DEG.
    POPULATION =    2.4 MILLION
    CENTER-CITY COORDINATES-- 31.5KM. N,  40.5KM. E
```

```
  NO. OF RECEPTORS=  1--THEIR ID'S AND COORDINATES (X,Y--KM.) FOLLOW--
     1 31.00 31.00

  NO. OF WIND STA.=  1--THEIR ID'S AND COORDINATES (X,Y--KM.) FOLLOW--
     1 32.30 33.00
  STREET CANYON MODEL USED-- NO
  TRAFFIC/LINE-SOURCE MODEL USED--

  HOLIDAY--        -0
  1ST/LAST HOURS  18  22
  A   VERAGE UPWIND CONC. (UG/M3) OF HC FOR 16 DIRECT. (1=NNE)--
 600.   700.   500.   500.   400.   300.   250.   300.   400.   450.   500.   200.   550.   450.   500.   500.

 DIRECT INPUT OF MIXING DEPTH --NO

    RAOB INPUTS--
ST. LOUIS      80      8   26   84   58   -0
                      15.8                993.0
                      18.3                989.0
                      21.5                981.0
                      22.6                977.0
                      21.9                946.0
                      15.4                850.0
                       9.7                783.0
                       7.6                729.0
                       5.5                700.0
                       2.0                630.0
                      -9.5                500.0

 MET. DATA INPUTS--
HOUR      0     1     2     3     4     5     6     7     8     9    10    11    12    13    14    15    16    17    18    19    20    21    22    23
CLOUD     0     0     0     0     0     0     0     0     0     0     0     0     0     1     1     1     1     0     0     0     0     0     0     0
TEMP.    67    66    66    65    64    61    61    65    68    72    76    79    81    82    83    84    82    80    76    71    68    64    61    60
DIR.      0    27    26    33    27    27    36     3     6     9    12    15    18    21    24    27    30    33    34    36     1     2     1    36
SPEED   0.0   4.0   4.0  16.0   4.0   4.0   4.0   5.0  10.0   5.0   5.0   5.0  10.0  13.0  14.0  14.0   9.0   5.0  13.0  10.0   9.0   8.0   7.0   7.0

    RAOB INPUTS--
 ST LOUIS      80      8   27   76   53   -0
                      11.9                996.5
                      14.4                979.0
                      13.2                928.0
                      10.6                883.0
                      10.4                850.0
                      11.3                829.0
                       6.8                742.0
                       7.5                728.0
                       6.1                700.0
                       5.0                658.0
                       2.5                614.0
                      -3.7                555.0
                      -7.8                500.0
```

```
800826    HC   ST LOUIS
 CONCENTRATIONS (CO=100-UG/M3.HC=10-UG/M3.NOX=UG/M3) LOCAL WIND SPEEDS/DIRECTIONS (M/S. DEG)--

                                                    HOURS
          18    19    20    21    22
CLOUD      0     0     0     0     0
TEMP--K  297   294   293   290   289
STAB.      4     4     4     4     4
MIX HT 1052.  741.  624.  507.  390.

   STATION     1
WND SPD    7     5     5     4     4
WND DIR  340   360    10    20    10
CONCEN  652.  459.  369.  126.  357.
```

EMISSIONS PREPROCESSOR INPUTS: PROBLEM 2

```
CARD        10        20        30        40        50        60        70        80
 NO.........*.........*.........*.........*.........*.........*.........*.........*
  1 QISMAP                                            YES
  2 INSPEC                                            NO
  3 USRMYM/YSRMYR                                     NO        NO
  4 USRMIX                                            NO
  5 REGION                                            LOW
  6 CY                                                1985
  7 QPOL                                              NO        YES       NO
  8                                                   2
  9 KHR1.NHRSIM                                        8         1
 10        65.
```

EMISSIONS PREPROCESSOR OUTPUT: PROBLEM 2

```
                HOUR =     8      TEMP =  65.0

           CO  COMPOSITE EMISSION FACTCRS

                    LOCALE/FACILITY TYPE:
 SPEED       1        2        3        4        5        6
 -----    ------   ------   ------   ------   ------   ------
   5.0    127.81   127.81   208.82   159.02   159.02   237.38
   5.0    127.81   127.81   208.82   159.02   159.02   237.38
   7.5    105.06   105.06   162.06   135.29   135.29   190.52
  10.5     92.01    92.01   133.50   121.64   121.64   161.90
  13.5     85.34    85.34   118.26   114.67   114.67   146.63
  16.5     81.39    81.39   109.18   110.53   110.53   137.54
  19.5     78.63    78.63   103.15   107.65   107.65   131.49
  22.5     76.40    76.40    98.68   105.34   105.34   127.02
  25.5     74.42    74.42    95.07   103.29   103.29   123.40
  28.5     72.65    72.65    91.98   101.47   101.47   120.30
  31.5     71.10    71.10    89.31    99.88    99.88   117.63
  34.5     69.83    69.83    87.04    98.57    98.57   115.36
  37.5     68.86    68.86    85.19    97.56    97.56   113.51
  40.5     68.20    68.20    83.78    96.88    96.88   112.09
  43.5     67.82    67.82    82.78    96.48    96.48   111.10
  46.5     67.65    67.65    82.14    96.30    96.30   110.46
  49.5     67.57    67.57    81.72    96.20    96.20   110.03
  52.5     67.34    67.34    81.27    95.97    95.97   109.58
  55.5     66.66    66.66    80.43    95.28    95.28   108.74
  58.5     65.26    65.26    78.74    93.87    93.87   107.05
```

```
                                     CO  RATIO BY MODEL YEAR AND SPEED
SPEED     1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20
-----   ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ----
  5.0   1.09 1.09 1.11 1.07 1.07 1.09 1.09 1.08 1.08 1.17 1.17 1.18 1.18 1.19 1.49 1.51 1.53 1.58 1.67 1.76
  5.0   1.09 1.09 1.11 1.07 1.07 1.09 1.09 1.08 1.08 1.17 1.17 1.18 1.18 1.19 1.49 1.51 1.53 1.58 1.67 1.76
  7.5   1.09 1.09 1.11 1.08 1.09 1.10 1.10 1.10 1.10 1.17 1.18 1.18 1.18 1.19 1.50 1.52 1.54 1.59 1.69 1.77
 10.5   1.09 1.09 1.12 1.10 1.10 1.11 1.11 1.11 1.11 1.17 1.17 1.17 1.18 1.18 1.49 1.50 1.53 1.57 1.67 1.75
 13.5   1.09 1.09 1.12 1.11 1.11 1.12 1.12 1.12 1.12 1.16 1.16 1.16 1.17 1.17 1.46 1.48 1.50 1.55 1.64 1.72
 16.5   1.09 1.09 1.12 1.13 1.13 1.13 1.13 1.13 1.13 1.15 1.15 1.15 1.16 1.16 1.44 1.46 1.48 1.52 1.61 1.69
 19.5   1.09 1.09 1.13 1.14 1.14 1.14 1.13 1.13 1.14 1.14 1.14 1.15 1.15 1.16 1.43 1.45 1.47 1.51 1.60 1.67
 22.5   1.09 1.09 1.13 1.15 1.15 1.15 1.14 1.14 1.14 1.14 1.15 1.15 1.15 1.16 1.43 1.45 1.47 1.51 1.60 1.68
 25.5   1.09 1.09 1.13 1.16 1.16 1.16 1.14 1.15 1.16 1.15 1.15 1.16 1.16 1.16 1.45 1.46 1.49 1.53 1.62 1.70
 28.5   1.09 1.09 1.13 1.17 1.17 1.17 1.15 1.17 1.17 1.16 1.16 1.17 1.17 1.17 1.47 1.48 1.51 1.55 1.65 1.73
 31.5   1.09 1.09 1.14 1.17 1.18 1.18 1.16 1.18 1.18 1.17 1.17 1.18 1.18 1.19 1.50 1.51 1.54 1.58 1.68 1.76
 34.5   1.09 1.09 1.14 1.18 1.19 1.19 1.16 1.19 1.19 1.18 1.18 1.19 1.19 1.20 1.52 1.54 1.56 1.61 1.71 1.80
 37.5   1.09 1.09 1.14 1.19 1.20 1.20 1.17 1.20 1.20 1.19 1.19 1.20 1.20 1.21 1.53 1.55 1.58 1.63 1.73 1.82
 40.5   1.09 1.09 1.14 1.20 1.21 1.21 1.17 1.21 1.21 1.19 1.19 1.20 1.20 1.21 1.54 1.56 1.58 1.63 1.74 1.83
 43.5   1.09 1.09 1.14 1.21 1.22 1.22 1.17 1.21 1.21 1.19 1.19 1.19 1.20 1.20 1.53 1.55 1.58 1.63 1.73 1.82
 46.5   1.09 1.09 1.15 1.22 1.23 1.23 1.18 1.22 1.22 1.18 1.18 1.19 1.19 1.20 1.52 1.53 1.56 1.61 1.71 1.79
 49.5   1.09 1.09 1.15 1.23 1.24 1.23 1.18 1.22 1.22 1.17 1.18 1.18 1.18 1.19 1.50 1.52 1.54 1.59 1.69 1.77
 52.5   1.09 1.09 1.15 1.24 1.25 1.24 1.18 1.22 1.23 1.17 1.18 1.18 1.19 1.19 1.50 1.52 1.55 1.59 1.69 1.78
 55.5   1.09 1.09 1.15 1.24 1.26 1.26 1.17 1.24 1.24 1.19 1.20 1.20 1.21 1.21 1.55 1.56 1.59 1.64 1.75 1.84
 58.5   1.09 1.09 1.16 1.24 1.26 1.28 1.17 1.26 1.26 1.26 1.26 1.26 1.27 1.28 1.68 1.70 1.73 1.80 1.92 2.03

                               ACFAC BY MODEL YEAR
POL.     1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20
-----  ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ----
CO     1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00

                                    RATEN BY SPEED
POL.    5.   5.  7.5 10.5 13.5 16.5 19.5 22.5 25.5 28.5 31.5 34.5 37.5 40.5 43.5 46.5 49.5 52.5 55.5 58.5
-----  ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ----
CO     2.24 2.24 2.81 3.47 4.03 4.52 4.96 5.42 5.93 6.50 7.13 7.75 8.32 8.76 9.04 9.16 9.22 9.4110.0511.73
```

```
                                        CO  CORFAC BY MODEL YEAR AND SPEED
SPEED      1      2      3      4      5      6      7      8      9     10     11     12     13     14     15     16     17     18     19     20
-----  -----  -----  -----  -----  -----  -----  -----  -----  -----  -----  -----  -----  -----  -----  -----  -----  -----  -----  -----  -----
  5.0   2.44   2.44   2.48   2.40   2.41   2.43   2.44   2.43   2.43   2.62   2.62   2.63   2.64   2.65   3.34   3.37   3.43   3.54   3.75   3.94
  5.0   2.44   2.44   2.48   2.40   2.41   2.43   2.44   2.43   2.43   2.62   2.62   2.63   2.64   2.65   3.34   3.37   3.43   3.54   3.75   3.94
  7.5   3.06   3.06   3.12   3.05   3.05   3.08   3.09   3.08   3.08   3.29   3.30   3.31   3.33   3.34   4.21   4.26   4.33   4.47   4.74   4.98
 10.5   3.77   3.77   3.87   3.81   3.81   3.84   3.85   3.85   3.85   4.04   4.05   4.07   4.08   4.10   5.15   5.21   5.29   5.46   5.78   6.07
 13.5   4.39   4.39   4.52   4.49   4.49   4.50   4.51   4.51   4.52   4.66   4.67   4.69   4.70   4.73   5.90   5.96   6.06   6.24   6.60   6.92
 16.5   4.92   4.92   5.08   5.08   5.09   5.09   5.09   5.09   5.09   5.18   5.19   5.21   5.22   5.25   6.52   6.58   6.69   6.88   7.27   7.62
 19.5   5.40   5.40   5.59   5.64   5.64   5.63   5.62   5.63   5.64   5.67   5.68   5.70   5.72   5.74   7.11   7.18   7.29   7.50   7.93   8.30
 22.5   5.90   5.90   6.12   6.22   6.23   6.21   6.17   6.20   6.21   6.20   6.21   6.23   6.25   6.28   7.78   7.86   7.98   8.21   8.67   9.09
 25.5   6.46   6.46   6.71   6.87   6.87   6.85   6.79   6.85   6.85   6.82   6.83   6.85   6.88   6.91   8.59   8.68   8.82   9.08   9.59  10.06
 28.5   7.08   7.08   7.38   7.59   7.60   7.59   7.48   7.59   7.59   7.54   7.56   7.58   7.61   7.64   9.56   9.66   9.82  10.11  10.71  11.23
 31.5   7.76   7.76   8.10   8.37   8.40   8.39   8.23   8.40   8.40   8.34   8.36   8.39   8.42   8.46  10.65  10.77  10.95  11.29  11.96  12.57
 34.5   8.44   8.44   8.82   9.17   9.22   9.21   9.00   9.22   9.23   9.16   9.18   9.21   9.25   9.29  11.77  11.90  12.11  12.49  13.26  13.94
 37.5   9.06   9.06   9.48   9.92   9.98   9.97   9.70   9.98   9.99   9.89   9.92   9.95   9.99  10.04  12.77  12.91  13.14  13.56  14.40  15.16
 40.5   9.54   9.54  10.00  10.53  10.60  10.58  10.26  10.58  10.59  10.43  10.46  10.50  10.54  10.59  13.49  13.64  13.88  14.33  15.22  16.02
 43.5   9.84   9.84  10.33  10.95  11.02  11.00  10.61  10.96  10.97  10.73  10.76  10.79  10.84  10.89  13.84  13.99  14.24  14.69  15.60  16.42
 46.5   9.97   9.97  10.49  11.19  11.27  11.23  10.77  11.14  11.15  10.81  10.84  10.87  10.91  10.96  13.88  14.03  14.27  14.72  15.62  16.43
 49.5  10.03  10.03  10.57  11.36  11.44  11.38  10.85  11.24  11.25  10.82  10.85  10.88  10.92  10.97  13.84  13.99  14.23  14.67  15.55  16.35
 52.5  10.24  10.24  10.81  11.66  11.76  11.71  11.07  11.52  11.53  11.05  11.08  11.11  11.15  11.21  14.15  14.30  14.54  15.00  15.90  16.72
 55.5  10.94  10.94  11.58  12.50  12.63  12.64  11.81  12.43  12.44  12.01  12.04  12.08  12.12  12.19  15.55  15.73  16.01  16.53  17.56  18.49
 58.5  12.76  12.77  13.55  14.54  14.79  14.97  13.74  14.80  14.81  14.72  14.76  14.82  14.89  14.97  19.71  19.95  20.34  21.08  22.54  23.84

      EMIDLE:
CO  :   12.95
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APRAC-3 INPUTS: PROBLEM 2

```
CARD       10         20         30         40         50         60         70         80
 NO.........*.........*.........*.........*.........*.........*.........*.........*
 1  1 PRINT INPUTS                                         YES
 2  2 PRINT GRIDDED  PRIMARY EMISSIONS                     NO
 3  3 PRINT GRIDDED SECONDARY EMISSIONS                    NO
 4  4 PRINT GRIDDED TOTAL EMISSIONS                        NO
 5  5 PRINT TRAFFIC LINK FILE                              YES        YES
 6  6 CALCULATE FOR HC-CO-NOX                              NO         YES        NO
 7  7 USE DIFFUSION MODEL                                  YES
 8  8 AUTO COMPUTE SECONDARY TRAF.                         YES  NO
 9  9 USE CAPACITY RESTRAINT FOR SPEEDS                    NO
10  10 IS HOURLY VOLUME INPUT                              NO
11  11 ARE TRAFFIC INPUTS IN FHWA FORMAT                   NO
12  12 ARE SPEEDS SPECIFIED FOR EACH LINK                  YES
13  13 AREA IDENTIFIER                                     STL
14  14 ALTITUDE CATEGORY                                   LO
15  15 CALIF. CONTROLS                                     NO
16  16 NO.E-W/N-S GRID SQUARES--GRID SIZE KM<               25         25         3.
17  17 ORIGIN COORD. IN TRAFFIC SYSTEM<CONVER.FACTOR              0.0        0.0   0.01609
18  0.015      0.008      0.006      0.004      0.004      0.007      0.027      0.061
19  0.052      0.040      0.05       0.059      0.078      0.081      0.070      0.066
20  0.077      0.072      0.049      0.043      0.047      0.036      0.026      0.021
21  0.013      0.006      0.003      0.004      0.002      0.003      0.017      0.035
22  0.036      0.039      0.048      0.067      0.104      0.068      0.070      0.071
23  0.095      0.081      0.057      0.048      0.046      0.039      0.028      0.020
24  0.008      0.004      0.003      0.002      0.002      0.007      0.036      0.101
25  0.081      0.051      0.052      0.057      0.064      0.066      0.061      0.065
26  0.068      0.052      0.052      0.052      0.045      0.028      0.025      0.018
27  0.014      0.007      0.005      0.003      0.002      0.002      0.010      0.031
28  0.041      0.038      0.046      0.055      0.068      0.06       0.064      0.073
29  0.097      0.121      0.081      0.058      0.035      0.038      0.031      0.019
30  0.006      0.003      0.002      0.002      0.003      0.015      0.078      0.149
31  0.077      0.059      0.052      0.051      0.052      0.049      0.050      0.071
32  0.056      0.052      0.055      0.043      0.021      0.017      0.017      0.011
33  0.021      0.01       0.005      0.003      0.002      0.003      0.009      0.033
34  0.036      0.034      0.04       0.053      0.056      0.060      0.063      0.074
35  0.112      0.136      0.079      0.046      0.038      0.040      0.029      0.02
36  0.01       0.004      0.004      0.002      0.005      0.018      0.066      0.103
37  0.079      0.061      0.057      0.057      0.056      0.056      0.061      0.062
38  0.079      0.065      0.054      0.031      0.019      0.018      0.016      0.016
39  0.015      0.007      0.005      0.004      0.002      0.004      0.024      0.086
40  0.057      0.049      0.051      0.053      0.057      0.064      0.067      0.074
41  0.099      0.079      0.052      0.036      0.032      0.039      0.027      0.019
42  0.007      0.002      0.002      0.001      0.001      0.012      0.056      0.161
43  0.091      0.058      0.058      0.055      0.045      0.052      0.062      0.066
44  0.064      0.059      0.054      0.032      0.017      0.012      0.019      0.015
45  0.016      0.009      0.005      0.002      0.004      0.003      0.017      0.054
46  0.046      0.037      0.051      0.052      0.048      0.051      0.057      0.073
47  0.127      0.125      0.063      0.035      0.030      0.040      0.031      0.022
48  0.014      0.007      0.004      0.004      0.006      0.016      0.062      0.097
49  0.075      0.052      0.051      0.054      0.049      0.056      0.063      0.067
50  0.072      0.064      0.047      0.039      0.027      0.027      0.026      0.022
51  0.017      0.010      0.006      0.004      0.004      0.007      0.022      0.057
52  0.055      0.044      0.044      0.050      0.057      0.053      0.059      0.078
53  0.110      0.099      0.060      0.045      0.033      0.035      0.028      0.024
54  0.013      0.004      0.004      0.002      0.003      0.005      0.033      0.127
55  0.13       0.066      0.048      0.043      0.047      0.042      0.045      0.051
56  0.07       0.073      0.056      0.042      0.031      0.026      0.020      0.017
57  0.012      0.006      0.004      0.001      0.001      0.005      0.026      0.079
58  0.086      0.049      0.039      0.040      0.043      0.046      0.052      0.071
59  0.091      0.103      0.074      0.048      0.035      0.033      0.029      0.025
60  0.007      0.003      0.002      0.001      0.0        0.009      0.077      0.175
```

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CARD          10         20         30         40         50         60         70         80
 NO..........+.........+.........+.........+.........+.........+.........+.........+
 61 0.131      0.056      0.045      0.041      0.039      0.042      0.041      0.057
 62 0.059      0.059      0.045      0.032      0.023      0.021      0.023      0.013
 63 0.017      0.005      0.003      0.001      0.001      0.001      0.009      0.041
 64 0.049      0.034      0.032      0.034      0.035      0.035      0.043      0.070
 65 0.163      0.181      0.101      0.051      0.028      0.024      0.025      0.017
 66 0.009      0.006      0.004      0.003      0.005      0.011      0.055      0.094
 67 0.072      0.059      0.032      0.058      0.054      0.058      0.059      0.07
 68 0.083      0.068      0.051      0.039      0.033      0.034      0.023      0.018
 69 0.012      0.006      0.004      0.003      0.004      0.008      0.047      0.069
 70 0.053      0.052      0.055      0.056      0.052      0.061      0.063      0.073
 71 0.088      0.097      0.067      0.041      0.029      0.026      0.018      0.019
 72 0.011      0.006      0.005      0.004      0.007      0.023      0.110      0.117
 73 0.083      0.061      0.054      0.049      0.045      0.046      0.05       0.05
 74 0.065      0.058      0.042      0.037      0.021      0.019      0.021      0.017
 75 0.022      0.011      0.007      0.005      0.005      0.007      0.019      0.053
 76 0.045      0.045      0.045      0.047      0.043      0.05       0.053      0.07
 77 0.099      0.101      0.095      0.045      0.036      0.039      0.033      0.025
 78 0.012      0.004      0.0025     0.001      0.0005     0.0095     0.043      0.108
 79 0.09       0.045      0.0385     0.0375     0.037      0.0385     0.042      0.0635
 80 0.111      0.12       0.073      0.0425     0.0255     0.0225     0.024      0.015
 81 0.03       0.028      0.011      0.008      0.006      0.007      0.012      0.018
 82 0.024      0.033      0.034      0.041      0.042      0.041      0.038      0.037
 83 0.038      0.039      0.032      0.028      0.028      0.035      0.036      0.034
 84 0.03       0.028      0.011      0.008      0.006      0.007      0.012      0.018
 85 0.024      0.033      0.034      0.041      0.042      0.041      0.038      0.037
 86 0.038      0.039      0.032      0.028      0.028      0.035      0.036      0.034
 87 0.028      0.020      0.011      0.007      0.004      0.003      0.005      0.005
 88 0.01       0.011      0.014      0.02       0.023      0.023      0.025      0.025
 89 0.024      0.024      0.023      0.02       0.019      0.019      0.017      0.015
 90 0.01       0.011      0.014      0.02       0.023      0.023      0.025      0.025
 91 0.024      0.024      0.023      0.02       0.019      0.019      0.017      0.015
 92 0.028      0.020      0.011      0.007      0.004      0.003      0.005      0.005
 93 0.028      0.020      0.011      0.007      0.004      0.003      0.005      0.005
 94 0.01       0.011      0.014      0.02       0.023      0.023      0.025      0.025
 95 0.024      0.024      0.023      0.02       0.019      0.019      0.017      0.015
 96 0.028      0.020      0.011      0.007      0.004      0.003      0.005      0.005
 97 0.01       0.011      0.014      0.02       0.023      0.023      0.025      0.025
 98 0.024      0.024      0.023      0.02       0.019      0.019      0.017      0.015
 99     1.         1.         1.         1.
100       19.8
101 5.        25.       25.       10.       5.
102 40.1
103 10.       100.      21.       106.              1.        210.0               1 100000.  22.5
104 10.       100.      6.        108.              1.        210.0               1 100000.  22.5
105 10.       100.      38.       59.               1.        210.0               1 100000.  22.5
106 10.       100.      0.        97.               1.        210.0               1 100000.  22.5
107 9
108 1985   1   7  12      20.       STOP
109 LAT.POP.CENTER CITY                                38.6 2.36  31.5 40.5
110  NO. OF RECEPTORS                                   1
111      111.1609 1.4484
112 NO. OF WIND INPUTS                                  1
113 X.Y-W  1 32.0  33.0
114          ST. CANYON/INTERSECTION              NO          YES
115 INIT DISPRS/REC HTS/LANES   3    0    0    1    0    0    0    0    0 2 3 2 2 2 3 2 2
116 0.   97.  10.  100. 6.   108. 10.  100. 21.  106. 10.  100. 38.  58.  10.  100.
117 HOLIDAYS                              0827
118 1ST AND LAST HOUR                                    8    8
119 POLLUTANT                                       CO
120 UPWIND BACKGROUND -NNE THRU S                     00.   00.   00.   00.   00.   00.    0.   00.
121 UPWIND BACKGROUND  SSW THRU N                      0.    0.    0.    0.    0.    0.    0.    0.
122 DIRECT INPUT OF MIXING DEPTH                    NO
123 ST. LOUIS      850826    84    58
124 03879710826120102 -    0158095001740    09930              230002
125 03879710826120203 -    0183094002090    09890              251002
126 03879710826120304 -    0215048002790    09810              264003
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CARD       10        20        30        40        50        60        70        80
 NO.........+.........+.........+.........+.........+.........+.........+.........+
127 03879710826120405 -   0226032003140    09770               267003
128 03879710826120506 -   0219029005940    09460               295005
129 03879710826120607 -   0154031015110    08500               301007
130 03879710826120708 -   0097031022000    07830               310011
131 03879710826120809 -   0076005027900    07290               290014
132 03879710826120910 -   0055010031230    07000               290017
133 03879710826121011 -   0020004039780    06300               292017
134 03879710826121112 -  -095003058020    05000               302017
135              0    0   68         0     0
136              1    0   66        27     4
137              2    0   66        26     4
138              3    0   65        33    16
139              4    0   64        27     4
140              5    0   61        27     4
141 710826       6    0   61   58   36    04
142 710826       7    0   65   60    3    05
143 710826      .8   10   61   60   36  3.92
144 710826       9    0   72   59    9    05
145 710826      10    0   76   59   12    05
146 710826      11    0   79   59   15    05
147 710826      12    0   81   58   18    10
148 710826      13    1   82   59   21    13
149 710826      14    1   83   56   24    14
150 710826      15    1   84   54   27    14
151 710826      16    1   82   55   30    09
152 710826      17    0   80   56   33     5
153 710826      18    0   76   57   34    13
154 710826      19    0   71   56   36    10
155 710826      20    0   68   56   01    09
156 710826      21    0   64   56   02    08
157 710826      22    0   61   56   01    07
158 710826      23    0   60   56   36    07
159     1 1141           143  933        161   356        123   903        245.8 .8 .8 .8
160  2 240   30   30   10   10   33800360018003600   0    0    0    0    2    3    2    2
161      2  298   .1    .1  862   .1    .1  823   .1    .1  638    .1    .1.8 .8 .8 .8
162  1  60   30   30              3360036000000000
163  ST LOUIS       850827   76   53    1                                  2    2    2    2
164 03879710827120102 -   0119097001740    09965               350002
165 03879710827120203 -   0144096003230    09790               011004
166 03879710827120304 -   0132073007750    09280               012005
167 03879710827120405 -   0106084011920    08830               347006
168 03879710827120506 -   0104054015100    08500               331007
169 03879710827120607 -   0113030017190    08290               327007
170 03879710827120708 -   0068020026370    07420               316010
171 03879710827120809 -   0075006027940    07280               313009
172 03879710827120910 -   0061009031160    07000               319008
173 03879710827121011 -   0050009036210    06580               329014
174 03879710827121112 -   0025008041820    06140               328019
175 03879710827121213 -  -037009049890    05550               332018
176 03879710827121314 -  -078006058060    05000               335020
177 710827      0    0   58   56   01    06
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APRAC-3 OUTPUTS: PROBLEM 2

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PRINT INPUTS- YES
PRIMARY, SECONDARY, AND/OR TOTAL TRAFFIC GRIDS TO BE PRINTED-NO , NO , NO
PRINT LINK FILE-BEFORE YES
PRINT LINK FILE-AFTER YES
POLLUTANTS TO BE CONSIDERED- HC, NO  - CO, YES - NOX, NO
DIFFUSION MODEL TO BE USED- YES
AUTOMATIC COMPUTATION OF SECONDARY TRAFFIC- YES
ONLY BIG LINKS CONSIDERED  NO
MINIMUM VOLUME INCLUDED          -0.0
MAXIMUM LINKS INCLUDED  .          -0
SPEEDS FROM CAPACITY RESTRAINT-  NO
HOURLY TRAFFIC VOLUMES U SED (AS OPPOSED TO ADT) -NO
FHWA TRAFFIC- NO
SPEED SPECIFIED FOR NON-FHWA DATA- YES
AREA STL   IS LO ALTITUDE---CALIF.= NO
  3.000-KM. SQ. GRIDS--  25 IN E-W DIRECTION AND 25 N-S
THE ORIGIN OF THE GRID SYSTEM IS      0.000,     0.000(0.01 MILE UNITS--TRAFFIC COORD. SYSTEM)
TO CONVERT 0.01-MILE TO KM., MULTIPLY BY    .016090

DIURNAL TRAFFIC CYCLES, PRIMARY--

 DIRECTION 1.LOCATION CODE = 1.FRACTION/HR    .0150   .0080   .0060   .0040   .0040   .0070   .0270   .0610
                                              .0520   .0400   .0500   .0590   .0780   .0810   .0700   .0660
                                              .0770   .0720   .0490   .0430   .0470   .0360   .0260   .0210

 DIRECTION 2.LOCATION CODE = 1.FRACTION/HR    .0130   .0060   .0030   .0040   .0020   .0030   .0170   .0350
                                              .0360   .0390   .0480   .0670   .1340   .0680   .0700   .0710
                                              .0950   .0810   .0570   .0480   .0460   .0390   .0280   .0200

 DIRECTION 1.LOCATION CODE = 2.FRACTION/HR    .0080   .0040   .0030   .0020   .0020   .0070   .0360   .1010
                                              .0810   .0510   .0520   .0570   .0640   .0660   .0610   .0650
                                              .0680   .0520   .0520   .0520   .0450   .0280   .0250   .0180

 DIRECTION 2.LOCATION CODE = 2.FRACTION/HR    .0140   .0070   .0050   .0030   .0020   .0020   .0100   .0310
                                              .0410   .0380   .0460   .0550   .0680   .0600   .0640   .0730
                                              .0970   .1210   .0810   .0580   .0350   .0380   .0310   .0190

 DIRECTION 1.LOCATION CODE = 3.FRACTION/HR    .0060   .0030   .0020   .0020   .0030   .0150   .0780   .1490
                                              .0770   .0590   .0520   .0510   .0520   .0490   .0500   .0710
                                              .0560   .0520   .0550   .0430   .0210   .0170   .0170   .0110

 DIRECTION 2.LOCATION CODE = 3.FRACTION/HR    .0210   .0100   .0050   .0030   .0020   .0030   .0090   .0330
                                              .0360   .0340   .0400   .0530   .0560   .0600   .0630   .0740
                                              .1120   .1360   .0790   .0460   .0380   .0400   .0290   .0200

 DIRECTION 1.LOCATION CODE = 4.FRACTION/HR    .0100   .0040   .0040   .0020   .0050   .0180   .0660   .1030
                                              .0790   .0610   .0570   .0570   .0560   .0560   .0610   .0620
                                              .0790   .0650   .0540   .0310   .0190   .0180   .0160   .0160

 DIRECTION 2.LOCATION CODE = 4.FRACTION/HR    .0150   .0070   .0050   .0040   .0020   .0040   .0240   .0860
                                              .0570   .0490   .0510   .0530   .0570   .0640   .0670   .0740
                                              .0990   .0790   .0520   .0360   .0320   .0390   .0270   .0190

 DIRECTION 1.LOCATION CODE = 5.FRACTION/HR    .0070   .0020   .0020   .0010   .0010   .0120   .0560   .1610
                                              .0910   .0580   .0580   .0550   .0450   .0520   .0620   .0660
                                              .0640   .0590   .0540   .0320   .0170   .0120   .0190   .0150

 DIRECTION 2.LOCATION CODE = 5.FRACTION/HR    .0160   .0090   .0050   .0020   .0040   .0030   .0170   .0540
                                              .0460   .0370   .0510   .0520   .0480   .0510   .0570   .0730
                                              .1270   .1250   .0630   .0350   .0300   .0400   .0310   .0220
```

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DIRECTION 1.LOCATION CODE = 6.FRACTION/HR     .0140   .0070   .0040   .0040   .0060   .0160   .0620   .0970
                                              .0750   .0520   .0510   .0540   .0490   .0560   .0630   .0670
                                              .0720   .0640   .0470   .0390   .0270   .0270   .0260   .0220

DIRECTION 2.LOCATION CODE = 6.FRACTION/HR     .0170   .0100   .0060   .0040   .0040   .0070   .0220   .0570
                                              .0550   .0440   .0440   .0500   .0570   .0530   .0590   .0780
                                              .1100   .0990   .0600   .0450   .0330   .0350   .0280   .0240

DIRECTION 1.LOCATION CODE = 7.FRACTION/HR     .0130   .0040   .0040   .0020   .0030   .0050   .0330   .1270
                                              .1330   .0660   .0480   .0430   .0470   .0420   .0450   .0510
                                              .0700   .0730   .0560   .0420   .0310   .0260   .0200   .0170

DIRECTION 2.LOCATION CODE = 7.FRACTION/HR     .0120   .0060   .0040   .0010   .0010   .0050   .0260   .0790
                                              .0860   .0490   .0390   .0400   .0430   .0460   .0520   .0710
                                              .0910   .1030   .0740   .0480   .0350   .0330   .0290   .0250

DIRECTION 1.LOCATION CODE = 8.FRACTION/HR     .0070   .0030   .0020   .0010  0.0000   .0090   .0770   .1750
                                              .1310   .0560   .0450   .0410   .0390   .0420   .0410   .0570
                                              .0590   .0590   .0450   .0320   .0230   .0210   .0230   .0130

DIRECTION 2.LOCATION CODE = 8.FRACTION/HR     .0170   .0050   .0030   .0010   .0010   .0010   .0090   .0410
                                              .0490   .0340   .0320   .0340   .0350   .0350   .0430   .0700
                                              .1630   .1810   .1010   .0510   .0280   .0240   .0250   .0170

DIRECTION 1.LOCATION CODE = 9.FRACTION/HR     .0090   .0060   .0040   .0030   .0050   .0110   .0550   .0940
                                              .0720   .0590   .0320   .0580   .0540   .0580   .0590   .0700
                                              .0830   .0680   .0510   .0390   .0330   .0340   .0230   .0180

DIRECTION 2.LOCATION CODE = 9.FRACTION/HR     .0120   .0060   .0040   .0030   .0040   .0080   .0470   .0690
                                              .0530   .0520   .0550   .0560   .0520   .0610   .0630   .0730
                                              .0880   .0970   .0670   .0410   .0290   .0260   .0180   .0190

DIRECTION 1.LOCATION CODE =10.FRACTION/HR     .0110   .0060   .0050   .0040   .0070   .0230   .1100   .1170
                                              .0830   .0610   .0540   .0490   .0450   .0460   .0500   .0500
                                              .0650   .0580   .0420   .0370   .0210   .0190   .0210   .0170

DIRECTION 2.LOCATION CODE =10.FRACTION/HR     .0220   .0110   .0070   .0050   .0050   .0070   .0190   .0530
                                              .0450   .0450   .0450   .0470   .0430   .0500   .0530   .0700
                                              .0990   .1010   .0950   .0450   .0360   .0390   .0330   .0250

DIRECTION 1.LOCATION CODE =11.FRACTION/HR     .0120   .0040   .0025   .0010   .0005   .0095   .0430   .1080
                                              .0900   .0450   .0385   .0375   .0370   .0385   .0420   .0635
                                              .1110   .1200   .0730   .0425   .0255   .0225   .0240   .0150

DIRECTION 2.LOCATION CODE =11.FRACTION/HR     .0300   .0280   .0110   .0080   .0060   .0070   .0120   .0180
                                              .0240   .0330   .0340   .0410   .0420   .0410   .0380   .0370
                                              .0380   .0390   .0320   .0280   .0280   .0350   .0360   .0340

DIRECTION 1.LOCATION CODE =12.FRACTION/HR     .0300   .0280   .0110   .0080   .0060   .0070   .0120   .0180
                                              .0240   .0330   .0340   .0410   .0420   .0410   .0380   .0370
                                              .0380   .0390   .0320   .0280   .0280   .0350   .0360   .0340

DIRECTION 2.LOCATION CODE =12.FRACTION/HR     .0280   .0200   .0110   .0070   .0040   .0030   .0050   .0050
                                              .0100   .0110   .0140   .0200   .0230   .0230   .0250   .0250
                                              .0240   .0240   .0230   .0200   .0190   .0190   .0170   .0150
```

```
SECONDARY--WEEKDAY, SATURDAY, SUNDAY--
                                                  .0100   .0110   .0140   .0200   .0230   .0230   .0250   .0250
                                                  .0240   .0240   .0230   .0200   .0190   .0190   .0170   .0150
                                                  .0280   .0200   .0110   .0070   .0040   .0030   .0050   .0050

                                                  .0280   .0200   .0110   .0070   .0040   .0030   .0050   .0050
                                                  .0100   .0110   .0140   .0200   .0230   .0230   .0250   .0250
                                                  .0240   .0240   .0230   .0200   .0190   .0190   .0170   .0150

                                                  .0280   .0200   .0110   .0070   .0040   .0030   .0050   .0050
                                                  .0100   .0110   .0140   .0200   .0230   .0230   .0250   .0250
                                                  .0240   .0240   .0230   .0200   .0190   .0190   .0170   .0150

 SEASONAL ADJUSTMENTS (WINTER, SPRING, SUMMER, FALL)  1.0000  1.0000  1.0000  1.0000
AVG. SPEED (MPH) OF SECONDARY TRAFFIC =   15.800

 TOTAL TRAFFIC IN AREA (VEH.-MI. DURING PERIOD OF INTEREST)=        40.

 RELATIVE SECONDARY TRAFFIC BY LOCALE (CBD, SUBURB/CORE CITY COMMERCIAL, RESIDENT., INDUST., RURAL)--
 LATITUDE = 38.6 DEG.
 POPULATION =   2.4 MILLION
 CENTER-CITY COORDINATES-- 31.5KM. N.  40.5KM. E

 NO. OF RECEPTORS=  1--THEIR ID'S AND COORDINATES (X,Y--KM.) FOLLOW--
  111   .16  1.45

 NO. OF WIND STA.=  1--THEIR ID'S AND COORDINATES (X,Y--KM.) FOLLOW--
    1 32.00 33.00
 STREET CANYON MODEL USED--NO
 TRAFFIC/LINE-SOURCE MODEL USED--YES

 INITIAL DISPERSION IN LINE-SOURCE MODEL (M)= 3.0

 X-Y COORDINATES (0.01 MILE) FOR EACH END OF EACH OF THE 4 STREETS OF THE INTERSECTION FOLLOW--
              0.        97.        10.        100.
              6.       108.        10.        100.
             21.       106.        10.        100.
             38.        58.        10.        100.


  LINK 1 HAS 2 INBOUND LANES  0.00-M ABOVE THE RECEPTOR AND 2 OUTBOUND AT  0.00

  LINK 2 HAS 3 INBOUND LANES  0.00-M ABOVE THE RECEPTOR AND 3 OUTBOUND AT  0.00

  LINK 3 HAS 2 INBOUND LANES  0.00-M ABOVE THE RECEPTOR AND 2 OUTBOUND AT  0.00

  LINK 4 HAS 2 INBOUND LANES  0.00-M ABOVE THE RECEPTOR AND 2 OUTBOUND AT  0.00

 HOLIDAY--       827
 1ST/LAST HOURS    8   8
 A   VERAGE UPWIND CONC. (UG/M3) OF CC FOR 16 DIRECT. (1=NNE)--    0.    0.    0.    0.    0.    0.    0.
  0.    0.    0.    0.    0.    0.    0.    0.    0.
 DIRECT INPUT OF MIXING DEPTH --NO

    RAOB INPUTS--
ST. LOUIS       85      8   26    84    58    -0
                     15.8                  993.0
                     18.3                  989.0
                     21.5                  981.0
                     22.6                  977.0
                     21.9                  946.0
                     15.4                  850.0
                      9.7                  783.0
                      7.6                  729.0
                      5.5                  700.0
                      2.0                  630.0
                     -9.5                  500.0

 MET. DATA INPUTS--
HOUR     0    1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23
CLOUD    0    0    0    0    0    0    0    0   10    0    0    0    0    1    1    1    1    0    0    0    0    0    0    0
TEMF.   67   66   66   65   64   61   61   65   61   72   76   79   81   82   83   84   82   80   76   71   68   64   61   60
DIR.     0   27   26   33   27   27   36    3   36    9   12   15   18   21   24   27   30   33   34   36    1    2    1   36
SPEED  0.0  4.0  4.0 16.0  4.0  4.0  4.0  5.0  3.9  5.0  5.0  5.0 10.0 13.0 14.0 14.0  9.0  5.0 13.0 10.0  9.0  8.0  7.0  7.0

   INTERSECTION INPUTS--
      11141.  -0. 143. 933.  -0. 161. 356.  -0. 123. 903.  -0. 245..800.800.800.800
   2 240    30.    30.    10.    10.     3. 3800. 3600. 1800. 3600.    0.    0.    0.    0.   2   3   2   2

TRAFFIC LINK FILE AND EMISSIONS (G/LINK/HR)--AREA= STL   ALT= LO YEAR= 1985 SEASON= 3 HOUR=  8 DAY NO.  2 TEMP=  61.F
ID-A  ID-B     XA      YA      XB      YB  LENGTH  USE AREA FAC. VOLAB    VOLBA    CAP   LAF LOCL SPD.AB/BA    HC      CO      NO
  0     1     .16    1.61     .34    1.71  10.00    0     0   2     1.       1.100000.  000   1 23. 23. 0.         0.      0.
  0     2     .16    1.61     .10    1.74  10.00    0     0   2     1.       1.100000.  000   1 23. 23. 0.         0.      0.
  0     3     .16    1.61     .61     .95  10.00    0     0   2     1.       1.100000.  000   1 23. 23. 0.         0.      0.
  0     4     .16    1.61    0.00    1.56  10.00    0     0   2     1.       1.100000.  000   1 23. 23. 0.         0.      0.
INTERSECTION SIMULATION OUTPUTS--
                         PHASE 1
TIME                       30.                          PHASE 2
V/GC                     .21758                           30.                        PHASE 3
          NOR-APPR   SOU-APPR                           .20943                         10.                        PHASE 4
DELA           22.        17.            EAS-APPR   WES-APPR                         .07944                         10.
QUEUE          22.         6.                 22.        20.          N-APP-LE   S-APP-LE                        .06806
VOLUME       1141.       356.                 18.        17.               56.        47.        E-APP-LE   W-APP-LE
CAPACITY     1859.      1859.                933.       903.                1.         1.             36.        42.
V/GCAP      .21758     .06789               1579.      1761.              143.       123.              0.         1.
                                           .20943     .18176              199.       199.             161.       245.
                                                                        .07944     .06833             381.       381.
                                                                                                    .04472     .06806
```

AVERAGE EMISSIONS PER VEHICLE (GM/SEC) FOR A LOW ALT. LOCATION IN 1985.

	HYDROCARBONS			CARBON MONOXIDE		
SPEED (MPH)	ACCEL	DECEL	CRUISE	ACCEL	DECEL	CRUISE
1.5	0.000	0.000	0.000	0.813	0.214	0.312
4.5	0.000	0.000	0.000	0.772	0.201	0.279
7.5	0.000	0.000	0.000	0.938	0.239	0.316
10.5	0.000	0.000	0.000	1.134	0.281	0.352
13.5	0.000	0.000	0.000	1.306	0.313	0.368
16.5	0.000	0.000	0.000	1.471	0.340	0.373
19.5	0.000	0.000	0.000	1.650	0.367	0.374
22.5	0.000	0.000	0.000	1.872	0.401	0.379
25.5	0.000	0.000	0.000	2.158	0.446	0.393
28.5	0.000	0.000	0.000	2.525	0.504	0.416
31.5	0.000	0.000	0.000	2.979	0.577	0.451
34.5	0.000	0.000	0.000	3.515	0.663	0.497
37.5	0.000	0.000	0.000	4.108	0.756	0.553
40.5	0.000	0.000	0.000	4.720	0.852	0.614
43.5	0.000	0.000	0.000	5.311	0.942	0.678
46.5	0.000	0.000	0.000	5.872	1.027	0.746
49.5	0.000	0.000	0.000	6.452	1.117	0.825
52.5	0.000	0.000	0.000	7.205	1.239	0.936
55.5	0.000	0.000	0.000	8.474	1.452	1.127
58.5	0.000	0.000	0.000	11.016	1.892	1.513

```
EMISSIONS
LINK STOPS QUE  VOL   VEL     Q-ACCEL  DISTANCE Q-AT-SPEED  DISTANCE     Q-DECEL  DISTANCE Q-IDL-DC-AC DISTANCE Q-IDL-AC-DC DISTANCE
   1 1049  90.1284.   10. 0.2279E-010.3896E+02 0.1346E-010.0000E+00 0.1359E-010.3896E+02 0.5849E+000.4505E+02 0.1714E+010.4505E+02
   2  886  47.1094.   10. 0.2904E-010.4526E+02 0.1147E-010.6409E+01 0.1172E-010.4526E+02 0.8603E+000.2350E+02 0.2557E+010.2350E+02
   3  353  25. 479.   10. 0.1553E-010.4526E+02 0.5020E-020.8602E+02 0.5172E-020.4526E+02 0.7496E+000.1255E+02 0.2238E+010.1255E+02
   4  921  68.1148.   10. 0.2473E-010.4526E+02 0.1203E-010.6543E+03 0.1222E-010.4526E+02 0.6725E+000.3379E+02 0.1988E+010.3379E+02
   5                      0.1949E-010.4526E+02 0.6299E-020.5239E+02 0.6490E-020.4526E+02 0.9405E+000.1255E+02 0.2808E+010.1255E+02
   6                      0.2253E-010.4526E+02 0.1096E-010.0000E+00 0.1113E-010.4526E+02 0.6127E+000.3379E+02 0.1812E+010.3379E+02
   7                      0.2311E-010.3896E+02 0.1365E-010.3363E+02 0.1378E-010.3896E+02 0.5931E+000.4505E+02 0.1738E+010.4505E+02
   8                      0.2803E-010.4526E+02 0.1107E-010.6748E+03 0.1131E-010.4526E+02 0.8304E+000.2350E+02 0.2460E+010.2350E+02


    850826    CO ST. LOUIS
     CONCENTRATIONS (CO=100-UG/M3,HC=10-UG/M3,NOX=UG/M3) LOCAL WIND SPEEDS/DIRECTIONS (M/S, DEG)--

                                                  HOURS
              8
    CLOUD    10
    TEMP--K 289
    STAB.     4
    MIX HT  222.

        STATION  111
    WND SPD    2
    WND DIR  360
    CONCEN  879.
```

EMISSIONS PREPROCESSOR INPUT: PROBLEMS 3 & 4

```
CARD       10        20        30        40        50        60        70        80
 NO.........+.........+.........+.........+.........+.........+.........+.........+
 1 GISMAP                                            NO
 2 INSPEC                                            NO
 3 USRMYM/YSRMYR                                     NO        NO
 4 USRMIX                                            NO
 5 REGION                                            HIGH
 6 CY                                                1982
 7 GPOL                                              YES       YES       YES
 8 KHRI,NHRSIM                                       12        1
 9        20.
```

```
                 HOUR =   12     TEMP =  20.0

              HC  COMPOSITE EMISSION FACTORS


                      LOCALE/FACILITY TYPE:
  SPEED        1        2        3        4        5        6
  -----     ------   ------   ------   ------   ------   ------
    5.0      31.53    34.20    34.88    38.22    40.86    41.50
    5.0      31.53    34.20    34.88    38.22    40.86    41.50
    7.5      26.81    28.65    29.13    33.58    35.41    35.86
   10.5      23.91    25.24    25.60    30.74    32.05    32.38
   13.5      22.36    23.41    23.70    29.21    30.25    30.52
   16.5      21.44    22.32    22.57    28.30    29.17    29.40
   19.5      20.81    21.59    21.81    27.69    28.45    28.66
   22.5      20.34    21.04    21.24    27.23    27.92    28.11
   25.5      19.96    20.60    20.78    26.85    27.48    27.65
   28.5      19.62    20.22    20.39    26.52    27.11    27.27
   31.5      19.33    19.90    20.04    26.24    26.79    26.93
   34.5      19.08    19.62    19.75    25.99    26.52    26.64
   37.5      18.88    19.39    19.51    25.80    26.29    26.41
   40.5      18.73    19.21    19.33    25.65    26.12    26.23
   43.5      18.63    19.09    19.20    25.55    26.00    26.10
   46.5      18.57    19.01    19.12    25.49    25.92    26.03
   49.5      18.53    18.96    19.07    25.45    25.88    25.98
   52.5      18.49    18.92    19.02    25.41    25.83    25.93
   55.5      18.40    18.83    18.93    25.32    25.74    25.84
   58.5      18.22    18.64    18.73    25.15    25.56    25.64


              CO  COMPOSITE EMISSION FACTORS


                      LOCALE/FACILITY TYPE:
  SPEED        1        2        3        4        5        6
  -----     ------   ------   ------   ------   ------   ------
    5.0     331.11   386.24   386.38   383.99   438.16   438.15
    5.0     331.11   386.24   386.38   383.99   438.16   438.15
    7.5     266.06   304.25   304.32   320.20   357.73   357.69
   10.5     227.40   254.99   255.03   282.28   309.40   309.36
   13.5     207.26   229.09   229.11   262.52   283.97   283.93
   16.5     195.37   213.76   213.77   250.86   268.94   268.90
   19.5     187.33   203.47   203.47   243.00   258.86   258.81
   22.5     181.10   195.63   195.61   236.90   251.19   251.13
   25.5     175.75   189.05   189.02   231.69   244.76   244.69
   28.5     170.98   183.27   183.22   227.04   239.11   239.03
   31.5     166.78   178.20   178.14   222.95   234.16   234.07
   34.5     163.23   173.90   173.83   219.48   229.96   229.86
   37.5     160.43   170.47   170.40   216.75   226.61   226.50
   40.5     158.43   167.96   167.88   214.79   224.14   224.04
   43.5     157.19   166.33   166.25   213.58   222.54   222.44
   46.5     156.58   165.44   165.36   212.97   221.66   221.56
   49.5     156.28   164.93   164.85   212.68   221.16   221.06
   52.5     155.71   164.19   164.11   212.13   220.45   220.34
   55.5     154.03   162.31   162.22   210.50   218.63   218.51
   58.5     150.37   158.29   158.19   206.96   214.72   214.60
```

NOX COMPOSITE EMISSION FACTORS

	LOCALE/FACILITY TYPE:					
SPEED	1	2	3	4	5	6
5.0	3.34	3.41	3.46	4.82	4.88	4.93
5.0	3.34	3.41	3.46	4.82	4.88	4.93
7.5	3.24	3.30	3.34	4.73	4.78	4.82
10.5	3.20	3.24	3.28	4.69	4.72	4.77
13.5	3.22	3.24	3.29	4.71	4.73	4.77
16.5	3.28	3.29	3.34	4.76	4.77	4.81
19.5	3.36	3.37	3.42	4.83	4.84	4.89
22.5	3.46	3.46	3.51	4.92	4.92	4.97
25.5	3.55	3.55	3.61	5.01	5.00	5.06
28.5	3.64	3.64	3.70	5.09	5.08	5.14
31.5	3.72	3.71	3.78	5.17	5.15	5.21
34.5	3.79	3.77	3.84	5.23	5.21	5.27
37.5	3.84	3.82	3.89	5.27	5.26	5.32
40.5	3.88	3.86	3.93	5.31	5.29	5.36
43.5	3.91	3.90	3.97	5.34	5.32	5.39
46.5	3.95	3.93	4.00	5.38	5.35	5.42
49.5	4.00	3.98	4.06	5.42	5.40	5.47
52.5	4.08	4.06	4.14	5.50	5.47	5.54
55.5	4.21	4.18	4.26	5.61	5.58	5.66
58.5	4.39	4.37	4.45	5.78	5.75	5.83

APRAC-3 INPUTS: PROBLEM 3

```
CARD       10        20        30        40        50        60        70        80
NO..........*.........*.........*.........*.........*.........*.........*.........*
 1 1 PRINT INPUTS                                    NO
 2 2 PRINT GRIDDED  PRIMARY EMISSIONS                YES
 3 3 PRINT GRIDDED SECONDARY EMISSIONS               YES
 4 4 PRINT GRIDDED TOTAL EMISSIONS                   YES
 5 5 PRINT TRAFFIC LINK FILE                         NO        NO
 6 6 CALCULATE FOR HC-CO-NOX                         YES       YES       YES
 7 7 USE DIFFUSION MODEL                             NO
 8 8 AUTO COMPUTE SECONDARY TRAF.                    YES  NO          0.0   000
 9 9 USE CAPACITY RESTRAINT FOR SPEEDS               YES
10 10 IS HOURLY VOLUME INPUT                         NO
11 11 ARE TRAFFIC INPUTS IN FHWA FORMAT              YES
12 12 ARE SPEEDS SPECIFIED FOR EACH LINK             NO
13 13 AREA IDENTIFIER                                DENVER
14 14 ALTITUDE CATEGORY                              HI
15 15 CALIF. CONTROLS                                NO
16 16 NO.E-W/N-S GRID SQUARES--GRID SIZE KM<          25       25       5.
17 17 ORIGIN COORD. IN TRAFFIC SYSTEM<CONVER.FACTOR  41500.    44000.      0.01609
18 0.015     0.008     0.006     0.004     0.004     0.007     0.027     0.061
19 0.052     0.040     0.05      0.059     0.078     0.081     0.070     0.066
20 0.077     0.072     0.049     0.043     0.047     0.036     0.026     0.021
21 0.013     0.006     0.003     0.004     0.002     0.003     0.017     0.035
22 0.036     0.039     0.048     0.067     0.104     0.068     0.070     0.071
23 0.095     0.081     0.057     0.048     0.046     0.039     0.028     0.020
24 0.008     0.004     0.003     0.002     0.002     0.007     0.036     0.101
25 0.081     0.051     0.052     0.057     0.064     0.066     0.061     0.065
26 0.068     0.052     0.052     0.052     0.045     0.028     0.025     0.018
27 0.014     0.007     0.005     0.003     0.002     0.002     0.010     0.031
28 0.041     0.038     0.046     0.055     0.068     0.06      0.064     0.073
29 0.097     0.121     0.081     0.058     0.035     0.038     0.031     0.019
30 0.006     0.003     0.002     0.002     0.003     0.015     0.078     0.149
31 0.077     0.059     0.052     0.051     0.052     0.049     0.050     0.071
32 0.056     0.052     0.055     0.043     0.021     0.017     0.017     0.011
33 0.021     0.01      0.005     0.003     0.002     0.003     0.009     0.033
34 0.036     0.034     0.04      0.053     0.056     0.060     0.063     0.074
35 0.112     0.136     0.079     0.046     0.038     0.040     0.029     0.02
36 0.01      0.004     0.004     0.002     0.005     0.018     0.066     0.103
37 0.079     0.061     0.057     0.057     0.056     0.056     0.061     0.062
38 0.079     0.065     0.054     0.031     0.019     0.018     0.016     0.016
39 0.015     0.007     0.005     0.004     0.002     0.004     0.024     0.086
40 0.057     0.049     0.051     0.053     0.057     0.064     0.067     0.074
41 0.099     0.079     0.052     0.036     0.032     0.039     0.027     0.019
42 0.007     0.002     0.002     0.001     0.001     0.012     0.056     0.161
43 0.091     0.058     0.058     0.055     0.045     0.052     0.062     0.066
44 0.064     0.059     0.054     0.032     0.017     0.012     0.019     0.015
45 0.016     0.009     0.005     0.002     0.004     0.003     0.017     0.054
46 0.046     0.037     0.051     0.052     0.048     0.051     0.057     0.073
47 0.127     0.125     0.063     0.035     0.030     0.040     0.031     0.022
48 0.014     0.007     0.004     0.004     0.006     0.016     0.062     0.097
49 0.075     0.052     0.051     0.054     0.049     0.056     0.063     0.067
50 0.072     0.064     0.047     0.039     0.027     0.027     0.026     0.022
51 0.017     0.010     0.006     0.004     0.004     0.007     0.022     0.057
52 0.055     0.044     0.044     0.050     0.057     0.053     0.059     0.078
53 0.110     0.099     0.060     0.045     0.033     0.035     0.028     0.024
54 0.013     0.004     0.004     0.002     0.003     0.005     0.033     0.127
55 0.13      0.066     0.048     0.043     0.047     0.042     0.045     0.051
56 0.07      0.073     0.056     0.042     0.031     0.026     0.020     0.017
57 0.012     0.006     0.004     0.001     0.001     0.005     0.026     0.079
58 0.086     0.049     0.039     0.040     0.043     0.046     0.052     0.071
59 0.091     0.103     0.074     0.048     0.035     0.033     0.029     0.025
60 0.007     0.003     0.002     0.001     0.0       0.009     0.077     0.175
61 0.131     0.056     0.045     0.041     0.039     0.042     0.041     0.057
```

```
CARD        10        20        30        40        50        60        70        80
 NO..........*.........*.........*.........*.........*.........*.........*.........*
 62 0.059     0.059     0.045     0.032     0.023     0.021     0.023     0.013
 63 0.017     0.005     0.003     0.001     0.001     0.001     0.009     0.041
 64 0.049     0.034     0.032     0.034     0.035     0.035     0.043     0.070
 65 0.163     0.181     0.101     0.051     0.028     0.024     0.025     0.017
 66 0.009     0.006     0.004     0.003     0.005     0.011     0.055     0.094
 67 0.072     0.059     0.032     0.058     0.054     0.058     0.059     0.07
 68 0.083     0.068     0.051     0.039     0.033     0.034     0.023     0.018
 69 0.012     0.006     0.004     0.003     0.004     0.008     0.047     0.069
 70 0.053     0.052     0.055     0.056     0.052     0.061     0.063     0.073
 71 0.088     0.097     0.067     0.041     0.029     0.026     0.018     0.019
 72 0.011     0.006     0.005     0.004     0.007     0.023     0.110     0.117
 73 0.083     0.061     0.054     0.049     0.045     0.046     0.05      0.05
 74 0.065     0.058     0.042     0.037     0.021     0.019     0.021     0.017
 75 0.022     0.011     0.007     0.005     0.005     0.007     0.019     0.053
 76 0.045     0.045     0.045     0.047     0.043     0.05      0.053     0.07
 77 0.099     0.101     0.095     0.045     0.036     0.039     0.033     0.025
 78 0.012     0.004     0.0025    0.001     0.0005    0.0095    0.043     0.108
 79 0.09      0.045     0.0385    0.0375    0.037     0.0385    0.042     0.0635
 80 0.111     0.12      0.073     0.0425    0.0255    0.0225    0.024     0.015
 81 0.03      0.028     0.011     0.008     0.006     0.007     0.012     0.018
 82 0.024     0.033     0.034     0.041     0.042     0.041     0.038     0.037
 83 0.038     0.039     0.032     0.028     0.028     0.035     0.036     0.034
 84 0.03      0.028     0.011     0.008     0.006     0.007     0.012     0.018
 85 0.024     0.033     0.034     0.041     0.042     0.041     0.038     0.037
 86 0.038     0.039     0.032     0.028     0.028     0.035     0.036     0.034
 87 0.028     0.020     0.011     0.007     0.004     0.003     0.005     0.005
 88 0.01      0.011     0.014     0.02      0.023     0.023     0.025     0.025
 89 0.024     0.024     0.023     0.02      0.019     0.019     0.017     0.015
 90 0.01      0.011     0.014     0.02      0.023     0.023     0.025     0.025
 91 0.024     0.024     0.023     0.02      0.019     0.019     0.017     0.015
 92 0.028     0.020     0.011     0.007     0.004     0.003     0.005     0.005
 93 0.028     0.020     0.011     0.007     0.004     0.003     0.005     0.005
 94 0.01      0.011     0.014     0.02      0.023     0.023     0.025     0.025
 95 0.024     0.024     0.023     0.02      0.019     0.019     0.017     0.015
 96 0.028     0.020     0.011     0.007     0.004     0.003     0.005     0.005
 97 0.01      0.011     0.014     0.02      0.023     0.023     0.025     0.025
 98 0.024     0.024     0.023     0.02      0.019     0.019     0.017     0.015
 99    1.        1.         1.        1.
100      19.8
101 50.0   55.0    55.0     55.0    55.0    10.0    22.0    12.0    12.0    45.0
102   10000.   2500.
103      10.     25.     35.     25.     10.
104 20000000.
105 1982   1   7  12     20.      STOP
```

TRAFFIC TAPE INPUTS: Problems 3 and 4
(From program COMSIS)

```
         10        20        30        40        50        60        70
.........+.........+.........+.........+.........+.........+.........+.
*PULL SAN FRANCISCO AREA FROM MTC 1965 PEAK ASSIGNMENT (08/27/76)
* INSERT BRIDGE TOOLS
*
** INTERSECTION RECORD FORMAT
*
*WORD1-  BYTE 0,    LEG PRES. INDICATOR BITS.    BYTES 1-3, A-NODE OF
*        INTERSECTION.
*WORD2-  BYTES 0-1,  B-NODE CONNECTED TO A0.    BYTES 2-3,  B-NODE CON
*        NECTED TO A1.
*WORD3-  BYTES 0-1,  B-NODE CONNECTED TO A2.    BYTES 2-3,  B-NODE CON
*        NECTED TO A3.
*WORD4-  TURN PENALTIES.  BYTE 0 FOR LEG 0,    BYTE 1 FOR LEG 1,  ETC.
*
*WORD5-  BYTES 0-1, ORIGINAL A-NODE. BYTES 2-3, LEFT PORTION OF A-NODE
*         X-COORDINATE.
*WORD6-  BYTE 0.  A-NODE X-COORDINATE, CONTINUED.  BYTES 1-3, A-NODE Y
*        -COORDINATE.
** LINK RECORD FORMAT
*
*WORD1-  BYTES 0-1, A-NODE AND LEG.  BYTES 2-3, LEFT PORTION OF B-NODE
*         X-COORDINATE.
*WORD2-  BYTE 0.  B-NODE X-COORDINATE, CONTINUED.  BYTES 1-3, B-NODE Y
*        -COORDINATE.
*WORD3-  BYTES 0-1, B-NODE, LEG, THIS LINK.   BYTE 2, COND, COL 79. BY
*        TE 3, COLUMN 80.
*WORD4-   LINK CARD FOLLOWS 01,64,65,66 X,BRIDGE-CODE,CONGESTION-CODE,
*        FUNC(FACILITY)
*WORD5-   LINK CARD FOLLOWS 67,68,69,70 X,SPEED-ZONE,X,X
*
*WORD6-   LINK CARD FOLLOWS 71-74
*
*WORD7-   LINK CARD FOLLOWS 75-78
*
*WORD8-  BYTES 1-3 CONTAIN COUNT, A-TO-B.
*
*WORD9-  BYTES 1-3 CONTAIN COUNT, B-TO-A.
*
*WORD10- BYTES 0-1, HR/ADT, A-TO-B, COLS 29-31.  BYTES 2-3, HRLY CAPAC
*        ITY, A-TO-B.
*WORD11- BYTES 0-1, HR/ADT, B-TO-A, COLS 52-54.  BYTES 2-3, HRLY CAPAC
*        ITY, B-TO-A.
*WORD12-  LINK CARD FOLLOWS 40,39,37,38 38-40=OPP. OF CC 19-21
*
*WORD13-  LINK CARD FOLLOWS 63,62,60-61 61-63=OPP. OF CC 42-44
*
*WORD14- A-TO-B DATA.  BYTES 0-1, UNLOADED TRAVELTIME.  BYTES 2-3, DIS
*        TANCE.
*WORD15- B-TO-A DATA.  BYTES 0-1, UNLOADED TRAVELTIME.  BYTES 2-3, DIS
*        TANCE.
*WORD16- A-TO-B DATA.  BYTES 0-1, OBSERVED SPEED.  BYTES 2-3, OBSERVED
*         TRAVELTIME.
*WORD17- B-TO-A DATA.  BYTES 0-1, OBSERVED SPEED.  BYTES 2-3, OBSERVED
*         TRAVELTIME.
*WORD18- A-TO-B DATA FOR FIRST ASSIGNMENT.  BYTES 0-1, SPEED.  BYTES 2
*        -3, TRAVELTIME.
*WORD19- B-TO-A DATA FOR FIRST ASSIGNMENT.  BYTES 0-1, SPEED.  BYTES 2
*        -3, TRAVELTIME.
*LOAD ID* PEAK HOUR ASSIGNMENT NO. 1 ON MTC HWY04 NETWORK   8/25/76
```

```
        10        20        30        40        50        60        70
.........+.........+.........+.........+.........+.........+.........+.
*
*PATHSO-TREES BUILT FROM BYTES 063-064 (NOT OFFSET)  8/25/76 21.53.44
*
*ORIGINAL FILE   VOLID = MT4056  DSNAME = HWY4PK32.PT.ITER1
*
***** NEXT FIVE WORDS INSERTED BY LOADVN PROGRAM - TREE INPUT, LINK-LC
*        AD OUTPUT.
**WORD 20 - HALF-WORD OF ZERO, HALF-WORD FOR IMPEDANCE, A-TO-B.
*
**WORD 21 - HALF-WORD OF ZERO, HALF-WORD FOR IMPEDANCE, B-TO-A.
*
**WORD 22 - TURN 0-1, 1-0, 2-0, OR 3-0, ALL 1S IF LOCAL LINK OR IF NO
*        TURNS REQUESTED.
**WORD 23 - TURN 0-2, 1-2, 2-1, OR 3-1, OR LINK-LOAD FROM A-NODE.
*
**WORD 24 - TURN 0-3, 1-3, 2-3, OR 3-2, OR LINK-LOAD INTO A-NODE.
*
**          CAPACITY RESTRAINT RUN
*
**WORD 25 - 0-1 = A-B BALANCE SPEED    2-3 = A-B BALANCE TIME
*
**WORD 26 - 0-1 = B-A BALANCE SPEED    2-3 = B-A BALANCE TIME
*
**WORD 27 - 0-1 = A-B ASSIGNMENT SPEED 2-3 = A-B ASSIGNMENT TIME
*
**WORD 28 - 0-1 = B-A ASSIGNMENT SPEED 2-3 = B-A ASSIGNMENT TIME
*
*LOAD ID* PEAK HOUR ASSIGNMENT NO. 2 ON MTC HWY04 NETWORK   8/25/76
*
*PATHSO-TREES BUILT FROM BYTES 107-108 (NOT OFFSET)  8/25/76 22.00.11
*
*ORIGINAL FILE   VOLID = MT4056  DSNAME = HWY4PK32.PT.ITER2
*
***** NEXT FIVE WORDS INSERTED BY LOADVN PROGRAM - TREE INPUT, LINK-LC
*        AD OUTPUT.
**WORD 29 - HALF-WORD OF ZERO, HALF-WORD FOR IMPEDANCE, A-TO-B.
*
**WORD 30 - HALF-WORD OF ZERO, HALF-WORD FOR IMPEDANCE, B-TO-A.
*
**WORD 31 - TURN 0-1, 1-0, 2-0, OR 3-0, ALL 1S IF LOCAL LINK OR IF NO
*        TURNS REQUESTED.
**WORD 32 - TURN 0-2, 1-2, 2-1, OR 3-1, OR LINK-LOAD FROM A-NODE.
*
**WORD 33 - TURN 0-3, 1-3, 2-3, OR 3-2, OR LINK-LOAD INTO A-NODE.
*
**          CAPACITY RESTRAINT RUN
*
**WORD 34 - 0-1 = A-B BALANCE SPEED    2-3 = A-B BALANCE TIME
*
**WORD 35 - 0-1 = B-A BALANCE SPEED    2-3 = B-A BALANCE TIME
*
**WORD 36 - 0-1 = A-B ASSIGNMENT SPEED 2-3 = A-B ASSIGNMENT TIME
*
**WORD 37 - 0-1 = B-A ASSIGNMENT SPEED 2-3 = B-A ASSIGNMENT TIME
*
*LOAD ID* PEAK HOUR ASSIGNMENT NO. 3 ON MTC HWY04 NETWORK   8/25/76
*
*PATHSO-TREES BUILT FROM BYTES 143-144 (NOT OFFSET)  8/25/76 22.07.13
*
```

```
        10        20        30        40        50        60        70
.........+.........+.........+.........+.........+.........+.........+
*ORIGINAL FILE   VOLID = MT4056  DSNAME = HWY4PK32.PT.ITER3
*
***** NEXT FIVE WORDS INSERTED BY LOADVN PROGRAM - TREE INPUT, LINK-LC
*        AD OUTPUT.
**WORD 38 - HALF-WORD OF ZERO, HALF-WORD FOR IMPEDANCE, A-TO-B.
*
**WORD 39 - HALF-WORD OF ZERO, HALF-WORD FOR IMPEDANCE, B-TO-A.
*
**WORD 40 - TURN 0-1, 1-0, 2-0, OR 3-0, ALL 1S IF LOCAL LINK OR IF NO
*        TURNS REQUESTED.
**WORD 41 - TURN 0-2, 1-2, 2-1, OR 3-1, OR LINK-LOAD FROM A-NODE.
*
**WORD 42 - TURN 0-3, 1-3, 2-3, OR 3-2, OR LINK-LOAD INTO A-NODE.
*
**         CAPACITY RESTRAINT RUN
*
**WORD 43 - 0-1 = A-B BALANCE SPEED    2-3 = A-B BALANCE TIME
*
**WORD 44 - 0-1 = B-A BALANCE SPEED    2-3 = B-A BALANCE TIME
*
**WORD 45 - 0-1 = A-B ASSIGNMENT SPEED 2-3 = A-B ASSIGNMENT TIME
*
**WORD 46 - 0-1 = B-A ASSIGNMENT SPEED 2-3 = B-A ASSIGNMENT TIME
*
*LOAD ID* PEAK HOUR ASSIGNMENT NO. 4 ON MTC HWY04 NETWORK   8/25/76
*
*PATHSO-TREES BUILT FROM BYTES 179-180 (NOT OFFSET)  8/25/76 22.10.55
*
*ORIGINAL FILE   VOLID = MT4056  DSNAME = HWY4PK32.PT.ITER4
*
***** NEXT FIVE WORDS INSERTED BY LOADVN PROGRAM - TREE INPUT, LINK-LC
*        AD OUTPUT.
**WORD 47 - HALF-WORD OF ZERO, HALF-WORD FOR IMPEDANCE, A-TO-B.
*
**WORD 48 - HALF-WORD OF ZERO, HALF-WORD FOR IMPEDANCE, B-TO-A.
*
**WORD 49 - TURN 0-1, 1-0, 2-0, OR 3-0, ALL 1S IF LOCAL LINK OR IF NO
*        TURNS REQUESTED.
**WORD 50 - TURN 0-2, 1-2, 2-1, OR 3-1, OR LINK-LOAD FROM A-NODE.
*
**WORD 51 - TURN 0-3, 1-3, 2-3, OR 3-2, OR LINK-LOAD INTO A-NODE.
*
*THIS FILE DOES NOT CONTAIN ANY NODES LESS THAN 6000
*VOLUMES ARE EXTRACTED FROM WORDS 49 - 51
*FORMAT FOR DATA IS (2I5,4I8,I4,3I1,2I6,I5)
*DATA    B      XA      YA      XB      YB DISLAF VOLAB VOLBA  CAP
 6701 6702   43268   44465   43020   44470  42232  2349 16587 2776 445
 6701 6703   43268   44465   43285   44490   8322  9864 18630 2776 335
 6702 6704   43020   44470   43010   44470   6232  2349 19791 2776 445
 6702 6852   43020   44470   43082   44595  23232  3204     0 2776 445
 6703 6853   43285   44490   43361   44589  23322  6561     0 2776 335
 6703 6854   43285   44490   43508   44586  44232  3303 18630 2776 445
 6704 6915   43010   44470   43010   44596  21232  9747 68769 2776 445
 6719 6740   44862   44421   44915   44559  24232  7974 13113 6664 444
 6719 6813   44862   44421   44489   44570  74232 12159  3636 3332 444
 6726 6727   45079   44914   45091   44829   9232 29763     0 2499 444
 6726 6731   45079   44914   45068   45008  18232     0  3132  694 446
 6726 6792   45079   44914   45091   44995  12232     0 26631  833 447
 6727 6734   45091   44829   45116   44810  13232 10665     0  694 446
```

```
        10        20        30        40        50        60        70
.........+.........+.........+.........+.........+.........+.........+.
  6727 6735   45091   44829   45102   44791  12232 19098     0 1666 444
  6728 6729   45038   45112   45038   45077   9232  8199     0  694 446
  6728 6731   45038   45112   45068   45008  21231 59292     0 5139 441
  6728 6804   45038   45112   45012   45207  19231     0 67491 6852 441
  6729 6737   45038   45077   45087   44810  50232 13410  3564 2776 445
  6729 6743   45038   45077   45025   45120  11232  1098  5886 1388 445
  6729 6801   45038   45077   44968   45297  63232  3141     0 2776 445
  6730 6803   45080   45008   45022   45208  42232 69444     0 6852 443
  6730 6736   45080   45008   45129   44821  39232     0 53190 5139 443
  6730 6790   45080   45008   45111   44909  21232     0 16254  694 446
  6731 6734   45068   45008   45116   44810  39231 56160     0 6852 441
  6732 6734   45205   44555   45116   44810  53231     0 66825 5139 441
  6733 6736   45218   44552   45129   44821  53232 56835     0 5139 443
  6735 6742   45102   44791   45059   44728  15232 11358 12798 6664 444
  6735 6789   45102   44791   45118   44857  13232 20538     0 2499 444
  6736 6791   45129   44821   45125   44862  10232  3645     0  694 446
  6737 6738   45087   44810   45002   44694  27232  9252  2673 1388 445
  6738 6739   45002   44694   44920   44578  25232 13113  7974 6664 444
  6738 6742   45002   44694   45059   44728  13232 12798 11358 6664 444
  6739 6740   44920   44578   44915   44559   4232 13113  7974 6664 444
  6743 6787   45025   45120   45060   45110   8232  1098  6705 2776 445
  6743 6801   45025   45120   44968   45297  53232   819     0 2776 445
  6753 6754   45463   46075   45466   45925  28232     0  2034 2776 445
  6753 6767   45463   46075   45180   46060  53232     0  1251 2776 445
  6753 6937   45463   46075   45455   46264  39232  3285     0 1388 445
  6754 6755   45466   45925   45448   45798  25232     0   972 2776 445
  6754 6768   45466   45925   45382   45848  27232     0  1062 2776 445
  6755 6756   45448   45798   45700   45608  61232  5661 29250 2776 445
  6755 6758   45448   45798   45351   45492  63232     0   144 2776 445
  6755 6768   45448   45798   45382   45848  15232 28422  5661 2776 445
  6757 6758   45569   45323   45351   45492  51232     0  2565 1388 445
  6758 6784   45351   45492   45192   45605  38232    45   711 2776 445
  6758 6785   45351   45492   45208   45060  85232     0  2043 2776 445
  6763 6921   44998   45969   44992   45999   8232 10854     0 1666 444
  6763 6920   44998   45969   44972   45889  18232     0  3105 1666 444
  6763 6925   44998   45969   44961   45900  18232     0  7749 1388 446
  6764 6765   44895   45637   44893   45692  11232 15210   945 2776 445
  6764 6766   44895   45637   45068   45696  34232   945  1116 2776 445
  6764 6788   44895   45637   44951   45453  37232     0 14094 2776 445
  6765 6920   44893   45692   44972   45889  38232  3105     0 2776 445
  6765 6926   44893   45692   44690   45680  42322 15012  3852 1388 335
  6766 6783   45068   45696   45142   45640  18232   945  1116 2776 445
  6767 6768   45180   46060   45382   45848  51232 20250 22554 2776 445
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 7437 7443   44542   47493   44592   47500  10112  2538     0 2091 224
 7437 7457   44542   47493   44547   47461   7112  3600  4923 2404 225
 7438 7439   44538   47531   44487   47523  10112 54144     0 2091 224
 7438 7691   44538   47531   44508   47761  44112 11079  4437 2404 225
 7438 7441   44538   47531   44586   47536   7112     0 56016 2091 224
 7439 7440   44487   47523   44482   47556   6112 20736  4851 4182 224
 7440 7690   44482   47556   44454   47754  38112  7623  6165 4182 224
 7440 7697   44482   47556   44437   47550   8322 14427     0 2776 335
 7441 7442   44586   47536   44632   47543   9112     0 38925 2091 224
 7441 7443   44586   47536   44592   47500   7112     0 17091 1394 224
 7442 7476   44632   47543   44776   47563  29112     0 38925 2091 224
 7443 7444   44592   47500   44636   47506   9112  2538     0 2091 224
 7443 7454   44592   47500   44600   47434  13112     0 17091 1394 224
 7444 7453   44636   47506   44644   47441  13112  1656     0 2091 224
 7444 7475   44636   47506   44782   47526  29112   882     0 2091 224
 7449 7450   44510   47351   44560   47350  10112  8856     0 2091 224
 7450 7451   44560   47350   44610   47364  10112 13032     0 2091 224
 7450 7455   44560   47350   44550   47428  14112  4068  7515 2404 225
 7450 7550   44560   47350   44575   47254  20112  3339  4068 2404 225
 7451 7452   44610   47364   44655   47370   9112 13032     0 2091 224
 7451 7454   44610   47364   44600   47434  14112 17091     0 1394 224
 7451 7548   44610   47364   44624   47261  20112     0 17091 1394 224
 7452 7535   44655   47370   44800   47392  28112  6444     0 2091 224
 7452 7546   44655   47370   44670   47268  20112  8244     0 2091 224
 7452 7453   44655   47370   44644   47441  14112     0  1656 2091 224
 7455 7457   44550   47428   44547   47461   7112  4068  7515 2404 225
 7472 7473   44818   47605   44825   47570   7112 17523  7695 2404 225
 7472 7673   44818   47605   44796   47800  38112  6552  7974 2404 225
 7473 7474   44825   47570   44831   47532   7112 18828     0 2091 224
 7473 7476   44825   47570   44776   47563  10112 30636     0 2091 224
 7473 7494   44825   47570   45014   47593  35112     0 39636 1875 114
 7474 7478   44831   47532   44839   47467  13112 19710     0 2091 224
 7474 7493   44831   47532   45020   47557  36112   747     0 1875 114
 7474 7475   44831   47532   44782   47526  10112     0  1629 2091 224
 7475 7476   44782   47526   44776   47563   7112  8289     0 2091 224
 7475 7477   44782   47526   44788   47460  13112     0  9036 2091 224
 7477 7535   44788   47460   44800   47392  13112     0  9036 2091 224
 7478 7534   44839   47467   44850   47399  13112 19710     0 2091 224
 7488 7489   45215   47622   45180   47618   7112  9090     0 1875 114
 7488 7499   45215   47622   45234   47643   6112     0  9090 3462 115
 7489 7497   45180   47618   45141   47616   8112  9090     0 1875 114
 7493 7494   45020   47557   45014   47593   7112 74376     0 2500 114
 7493 7516   45020   47557   45022   47543   3112     0 73629 2500 114
 7494 7636   45014   47593   45000   47696  19112 47304     0 2788 224
 7494 7495   45014   47593   45060   47600   9112     0 12564 1875 114
 7495 7496   45060   47600   45105   47608   9112     0  9675 1875 114
 7495 7635   45060   47600   45047   47702  19112     0  2889 2091 224
 7496 7634   45105   47608   45091   47708  19112   720     0 1250 114
 7496 7497   45105   47608   45141   47616   7112     0  9090 1875 114
 7496 7498   45105   47608   45111   47576   7112     0  1305 1250 114
 7497 7517   45141   47616   45145   47582   7112   954     0 1875 114
 7497 7625   45141   47616   45125   47715  19112     0   954 2091 224
 7498 7506   45111   47576   45115   47527   9112     0  1305 1250 114
 7499 7608   45234   47643   45276   47597  13112     0  9090 2788 224
 7505 7506   45155   47563   45115   47527  10112   630     0 3462 115
 7505 7599   45155   47563   45201   47523  13112   324     0 2788 224
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        10        20        30        40        50        60        70
.........+.........+.........+.........+.........+.........+.........+
 7505 7517    45155   47563   45145   47582   3112     0   954 1875 114
 7506 7507    45115   47527   45087   47500   8112   630  1305 3462 115
 7507 7509    45087   47500   45073   47487   4112   630  1305 3462 115
 7509 7510    45073   47487   45035   47450  11112   630  2799 3462 115
 7509 7600    45073   47487   45116   47441  13112  1494     0 2091 224
 7510 7511    45035   47450   45002   47418   9112     0 10575 3462 115
 7510 7515    45035   47450   45030   47490   9112 21429     0 2500 114
 7510 7585    45035   47450   45072   47398  13112     0 13023 2788 224
 7511 7512    45002   47418   44960   47375  13112     0  2421 3462 115
 7511 7513    45002   47418   44947   47412  11112     0  8154 1875 114
 7512 7587    44960   47375   45005   47333  13112 11385     0 2091 224
 7512 7591    44960   47375   44892   47316  18112     0  7947 3462 115
 7512 7513    44960   47375   44947   47412   7112     0  5859 1875 114
 7513 7514    44947   47412   44937   47477  14112     0    54 1875 114
 7513 7534    44947   47412   44850   47399  19112     0 13959 2091 224
 7514 7671    44937   47477   44890   47813  65112     0    54 3462 115
 7515 7516    45030   47490   45022   47543  10112 21429     0 2500 114
 7534 7592    44850   47399   44871   47295  20112 12195     0 2091 224
 7534 7535    44850   47399   44800   47392  10112     0  6444 1731 115
 7535 7536    44800   47392   44817   47286  20112     0  9036 2091 224
 7536 7557    44817   47286   44703   47273  21112 16812     0 2091 224
 7536 7537    44817   47286   44818   47254   7112     0   747 2091 224
 7536 7592    44817   47286   44871   47295  10112     0 25101 1394 224
 7537 7593    44818   47254   44830   47257   3112  8739     0 2091 224
 7537 7538    44818   47254   44744   47244  15112     0  9486 2091 224
 7538 7547    44744   47244   44675   47234  14112     0 13833 2091 224
 7546 7547    44670   47268   44675   47234   7112 11844     0 2091 224
 7546 7548    44670   47268   44624   47261   9112 46593     0 2091 224
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 7547 7572    44675   47234   44696   47127  21112  7830     0 2091 224
 7547 7549    44675   47234   44628   47228   9112     0  9819 2091 224
 7548 7550    44624   47261   44575   47254  10112 44406     0 2091 224
 7548 7549    44624   47261   44628   47228   7112     0 14904 1394 224
 7549 7551    44628   47228   44580   47221   9112     0  1431 2091 224
 7549 7573    44628   47228   44650   47084  29112     0 23292 1394 224
 7550 7551    44575   47254   44580   47221   7112     0   774 2404 225
 7550 7552    44575   47254   44526   47249  10112 44451     0 2091 224
 7551 7553    44580   47221   44531   47214  10112     0  2205 2091 224
 7552 7553    44526   47249   44531   47214   7112  2916 36981 4182 224
 7553 7554    44531   47214   44550   47078  26112  2916 38151 4182 224
 7554 7555    44550   47078   44555   47043   7112   639 11187 4182 224
 7554 7558    44550   47078   44601   47084  10112     0 44685 2091 224
 7555 7556    44555   47043   44563   47000   9112   639 10422 4182 224
 7555 7565    44555   47043   44584   47045  11112   639     0 2788 224
 7556 7578    44563   47000   44612   47047  13112   333 11007 4808 225
 7558 7573    44601   47084   44650   47084   9112     0 44685 2091 224
 7564 7572    44673   47106   44696   47127  13112     0 31401 4808 225
 7564 7574    44673   47106   44694   47035  13112     0 47250 2091 224
 7567 7572    44762   47192   44696   47127  19112 59400     0 3606 225
 7567 7593    44762   47192   44830   47257  19112  1881  6435 3606 225
 7567 7579    44762   47192   44790   47165   6112     0 54846 2788 224
 7568 7571    44809   47144   44742   47081  18112     0  4266 2404 225
 7568 7579    44809   47144   44790   47165   8112 54846     0 2788 224
 7568 7594    44809   47144   44873   47206  18112 10350 54846 2404 225
 7568 7569    44809   47144   44853   47098  13112     0  6084 2788 224
 7569 7570    44853   47098   44786   47033  18322     0  1431 2776 335
 7569 7590    44853   47098   44985   47222  35322  7425     0 2776 335
 7570 7575    44786   47033   44737   46988  13322     0   810 2776 335
 7570 7571    44786   47033   44742   47081  13322     0 32787 3332 334
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         10        20        30        40        50        60        70
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 7571 7574    44742    47081    44694    47035   13322     0  1224 2776 335
 7571 7572    44742    47081    44696    47127   13112     0 35829 2788 224
 7573 7578    44650    47084    44612    47047   10112 11007   333 4808 225
 7574 7577    44694    47035    44658    47000   10322     0  2646 2776 335
 7574 7575    44694    47035    44737    46988   13322     0 45828 2499 334
 7575 7576    44737    46988    44703    46954   10322  9891   810 2776 335
 7576 7577    44703    46954    44658    47000   13322     0   738 2499 334
 7577 7578    44658    47000    44612    47047   13112     0   639 2091 224
 7585 7587    45072    47398    45005    47333   18112   324     0 2404 225
 7585 7600    45072    47398    45116    47441   12112     0   324 2404 225
 7585 7586    45072    47398    45115    47350   13112     0 13023 2788 224
 7586 7588    45115    47350    45049    47286   19112     0 30645 2404 225
 7586 7601    45115    47350    45158    47393   12112 22059  3510 2404 225
 7587 7588    45005    47333    45049    47286   13112 11385     0 2091 224
 7587 7589    45005    47333    44939    47268   18112   324     0 2404 225
 7588 7590    45049    47286    44985    47222   18112   216 48582 2404 225
 7589 7590    44939    47268    44985    47222   13112   720 21276 2404 225
 7589 7591    44939    47268    44892    47316   13112 20601  3933 2404 225
 7589 7594    44939    47268    44873    47206   18112  4212     0 2404 225
 7591 7592    44892    47316    44871    47295    7112 20601 11880 3606 225
 7592 7593    44871    47295    44830    47257   11112  6435 10620 3606 225
 7598 7601    45245    47478    45158    47393   24112  3510 23553 2404 225
 7598 7611    45245    47478    45272    47505    7112   207  3510 2404 225
 7599 7600    45201    47523    45116    47441   22112   324     0 2404 225
 7600 7601    45116    47441    45158    47393   13112  1494     0 2091 224
 7606 7608    45292    47576    45276    47597    6112  9090     0 1202 226
 7610 7611    45399    47628    45272    47505   34112     0   207 2404 225
 7610 7623    45399    47628    45366    47678   12232   207   621 4164 445
 7618 7625    45126    47726    45125    47715    3112   954     0 2091 224
 7618 7626    45126    47726    45123    47747    4112     0  2547 2091 224
 7619 7627    45310    47700    45213    47835   42322     0 61758 3426 333
 7620 7628    45320    47710    45225    47843   42322 15975     0 3426 333
 7623 7624    45366    47678    45328    47730   12232   207   621 4164 445
 7624 7646    45328    47730    45043    48095   88232   207   621 2776 445
 7626 7638    45123    47747    45087    47741    7112  9981     0 1394 224
 7626 7645    45123    47747    45108    47842   19322     0 12528 2499 334
 7627 7644    45213    47835    45075    47838   20322     0 61758 1388 336
 7628 7645    45225    47843    45108    47842   20322 15975     0 1388 336
 7633 7638    45090    47725    45087    47741    3112 46584     0 1394 224
 7633 7634    45090    47725    45091    47708    3112     0 34659 1394 224
 7634 7635    45091    47708    45047    47702    9112     0 33939 2091 224
 7635 7636    45047    47702    45000    47696    9112     0 33336 2091 224
 7635 7637    45047    47702    45040    47735    7112     0  3492 2091 224
 7636 7639    45000    47696    44988    47785   17112 13968     0 2788 224
 7637 7639    45040    47735    44988    47785   14112 11817   603 2404 225
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 7638 7665    45087    47741    45029    47832   19112 41859     0 1394 224
 7639 7670    44988    47785    44947    47822   11112 25785   603 2404 225
 7644 7645    45075    47838    45108    47842    7322   774  4221 2776 335
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 7646 7652    45043    48095    44990    48144   15232  5859 11367 2776 445
 7652 7653    44990    48144    44850    48122   27322  5859 11367 1388 335
 7653 7654    44850    48122    44753    48108   19322  9270  5130 1388 335
 7654 7655    44753    48108    44651    48093   20322  6444  3393 1388 335
 7654 7660    44753    48108    44771    47983   24322  2826  1737 2776 335
 7655 7660    44651    48093    44771    47983   29322  6210 15444 2776 335
 7655 7682    44651    48093    44464    48071   36322 21888  9603 2776 335
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 7660 7667    44771    47983    44780    47906   15322  5760  3384 2776 335
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         10        20        30        40        50        60        70
.........+.........+.........+.........+.........+.........+.........+
 7665 7669   45029   47832   44983   47825 36112     0 11358 2404 225
 7666 7667   44847   47915   44780   47906 13322  3141  1098 2776 335
 7666 7668   44847   47915   44880   47883  9112  4374 16938 2404 225
 7667 7673   44780   47906   44796   47800 20112  6489  3915 2404 225
 7667 7687   44780   47906   44541   47873 55112  4743  2898 1202 225
 7668 7670   44880   47883   44947   47822 17112  4374 16938 2404 225
 7669 7670   44983   47825   44947   47822  7112     0 11358 2404 225
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 7682 7688   44464   48071   44492   47867 39322   144  3600 2776 335
 7682 7721   44464   48071   44413   48063 10322 24579  8838 2776 335
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 7688 7689   44492   47867   44440   47860 10112  5823  3888 1202 225
 7688 7691   44492   47867   44508   47761 20112  1575  6714 2404 225
 7689 7690   44440   47860   44454   47754 20112  6165  7623 4182 224
 7689 7708   44440   47860   44428   47960 19322  7524  4131 4998 334
 7696 7704   44411   47750   44169   47716 28322     0  1638 1388 335
 7696 7709   44411   47750   44382   47953 40322  1638     0 3332 334
 7697 7698   44437   47550   44390   47542  9322 15498     0 2776 335
 7698 7699   44390   47542   44199   47515 36322 15498  1719 2776 335
 7699 7700   44199   47515   44149   47510 10322 11493  5049 2776 335
 7700 7701   44149   47510   43962   47485 36322 14598  4689 2776 335
 7700 7703   44149   47510   44122   47710 38322   351 12276 1388 337
 7701 7702   43962   47485   43932   47682 38322 15543  7083 2776 337
 7702 7703   43932   47682   44122   47710 36322   243  1800 1388 335
 7702 7713   43932   47682   43920   47784 19232 17343  7326 2082 447
 7703 7704   44122   47710   44169   47716 10322  2637  1629 1388 335
 7703 7710   44122   47710   44097   47912 38232     0 14490 1388 447
 7708 7709   44428   47960   44382   47953  9322  2142  8307 4164 335
 7708 7721   44428   47960   44413   48063 28322 12042  2484 4998 334
 7709 7710   44382   47953   44097   47912 55232  2142  6669 4164 445
 7710 7711   44097   47912   44065   47908  7232  2142 21159 4164 445
 7711 7712   44065   47908   43906   47885 30232   126 20628 4164 445
 7712 7713   43906   47885   43920   47784 19232  5049 15948 2082 447
 7718 7719   43918   48132   44216   48103 68232     0 29430 2776 445
 7718 7720   43918   48132   44224   48035 64232  4131     0 1388 445
 7719 7720   44216   48103   44224   48035 13232     0 29430 1388 445
 7720 7721   44224   48035   44413   48063 38232  4131 29430 2776 445
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TRAFFIC HEADER INFORMATION

END HEADER

APRAC-3 OUTPUTS: PROBLEM 3

```
5.00KM GRID OF PRI  HC  EMISSICNS IN G/HR FOR AREA= DENVE ALT=HI NONCAL  YEAR=1982 SEASON=1 DAY=7 HOUR=1200 TEMP=20.F
NORTH   GRIDS EAST--
GRIDS         1       2       3       4       5       6       7       8       9      10      11      12      13      14      15
   25   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   24   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   23   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   22   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   21   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   20   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   19   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   18   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   17   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   16   0.      0.      0.      0.       .35E+050.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   15   0.      0.      0.      0.       .56E+050.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   14   0.      0.      0.      0.       .61E+05 .40E+05 .30E+05 .28E+05 .31E+05 .27E+05 .17E+05 .87E+040.      0.       .11E+06
   13   0.      0.      0.      0.       .75E+04 .40E+05 .31E+04 .23E+05 .21E+05 .27E+05 .33E+05 .73E+05 .28E+05 .89E+05 .81E+05
   12   0.      0.      0.       .54E+04 .21E+05 .18E+05 .95E+03 .32E+05 .57E+05 .66E+05 .46E+05 .61E+05 .15E+06 .10E+060.
   11   0.      0.       .11E+05 .38E+05 .63E+05 .43E+05 .69E+05 .11E+06 .87E+05 .12E+06 .12E+06 .15E+06 .99E+050.      0.
   10   0.       .12E+05 .41E+04 .10E+05 .83E+05 .41E+05 .41E+05 .60E+05 .31E+05 .12E+06 .12E+06 .15E+06 .55E+040.      0.
    9   0.       .10E+05 .22E+05 .24E+05 .60E+05 .22E+05 .16E+05 .25E+05 .32E+05 .26E+05 .94E+05 .19E+06 .61E+040.      0.
    8   0.       .19E+05 .39E+05 .10E+05 .28E+05 .13E+05 .10E+05 .20E+05 .32E+04 .22E+05 .15E+05 .18E+06 .26E+040.      0.
    7   0.       .15E+05 .40E+040.       .27E+05 .14E+05 .24E+05 .33E+05 .74E+04 .28E+05 .12E+05 .19E+06 .22E+050.      0.
    6   0.       .11E+05 .81E+04 .11E+05 .62E+05 .22E+05 .59E+04 .16E+05 .16E+05 .17E+05 .17E+06 .46E+05 .44E+05 .18E+050.
    5   0.       .28E+04 .12E+05 .13E+05 .59E+05 .89E+04 .13E+05 .69E+05 .11E+06 .82E+05 .11E+06 .13E+06 .31E+04 .23E+030.
    4   0.       .10E+04 .35E+04 .10E+04 .52E+05 .74E+03 .29E+05 .64E+05 .21E+050.      0.       .12E+06 .64E+030.      0.
    3   0.      0.       .39E+04 .21E+04 .54E+05 .72E+05 .83E+05 .28E+05 .13E+05 .37E+040.       .11E+060.      0.      0.
    2   0.      0.       .76E+02 .29E+03 .35E+05 .21E+05 .12E+050.      0.       .87E+04 .17E+05 .19E+050.      0.      0.
    1   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
NORTH   GRIDS EAST--
GRIDS        16      17      18      19      20      21      22      23      24      25
   25   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   24   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   23   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   22   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   21   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   20   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   19   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   18   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   17   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   16   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   15    .68E+05 .59E+050.      0.      0.      0.      0.      0.      0.      0.
   14    .69E+050.      0.      0.      0.      0.      0.      0.      0.      0.
   13   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   12   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   11   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   10   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    9   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    8   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    7   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    6   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    5   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    4   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    3   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    2   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    1   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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5.00KM GRID OF SEC  HC  EMISSIONS IN G/HR FOR AREA= CENVE ALT=HI NONCAL  YEAR=1982 SEASON=1 DAY=7 HOUR=1200 TEMP=20.F
NORTH   GRIDS EAST--
GRIDS       1       2       3       4       5       6       7       8       9      10      11      12      13      14      15
   25   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   24   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   23   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   22   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   21   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   20   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   19   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   18   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   17   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   16   0.      0.      0.      0.       .80E+050.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   15   0.      0.      0.      0.       .13E+060.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   14   0.      0.      0.      0.       .10E+06 .62E+05 .46E+05 .42E+05 .48E+05 .35E+05 .19E+05 .11E+050.      0.       .17E+06
   13   0.      0.      0.      0.       .12E+05 .62E+05 .52E+04 .37E+05 .32E+05 .22E+05 .23E+05 .57E+05 .32E+05 .14E+06 .13E+06
   12   0.      0.      0.       .82E+04 .31E+05 .29E+05 .11E+04 .38E+05 .65E+05 .50E+05 .22E+05 .29E+05 .19E+06 .16E+060.
   11   0.      0.       .18E+05 .61E+05 .84E+05 .47E+05 .77E+05 .11E+06 .87E+05 .63E+05 .55E+05 .12E+06 .70E+050.      0.
   10   0.       .19E+05 .66E+04 .16E+05 .12E+06 .55E+05 .50E+05 .67E+05 .31E+05 .96E+05 .13E+06 .18E+06 .89E+040.      0.
    9   0.       .16E+05 .34E+05 .36E+05 .94E+05 .32E+05 .18E+05 .28E+05 .31E+05 .30E+05 .95E+05 .22E+06 .91E+040.      0.
    8   0.       .29E+05 .58E+05 .16E+05 .44E+05 .21E+05 .16E+05 .27E+05 .35E+04 .26E+05 .17E+05 .22E+06 .41E+040.      0.
    7   0.       .24E+05 .67E+040.       .42E+05 .21E+05 .38E+05 .49E+05 .85E+04 .32E+05 .15E+05 .29E+06 .34E+050.      0.
    6   0.       .17E+05 .12E+05 .18E+05 .98E+05 .35E+05 .94E+04 .25E+05 .25E+05 .23E+05 .26E+06 .74E+05 .71E+05 .27E+050.
    5   0.       .46E+04 .19E+05 .20E+05 .92E+05 .14E+05 .21E+05 .11E+06 .20E+06 .17E+06 .19E+06 .22E+06 .47E+04 .35E+030.
    4   0.       .16E+04 .54E+04 .17E+04 .83E+05 .12E+04 .52E+05 .13E+06 .33E+050.      0.       .22E+06 .97E+030.      0.
    3   0.      0.       .60E+04 .32E+04 .81E+05 .96E+05 .15E+06 .45E+05 .20E+05 .60E+040.       .21E+060.      0.      0.
    2   0.      0.       .12E+03 .44E+03 .47E+05 .30E+05 .18E+050.      0.       .14E+05 .27E+05 .39E+050.      0.      0.
    1   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
NORTH   GRIDS EAST--
GRIDS      16      17      18      19      20      21      22      23      24      25
   25   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   24   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   23   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   22   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   21   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   20   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   19   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   18   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   17   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   16   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   15    .11E+06 .95E+050.      0.      0.      0.      0.      0.      0.      0.
   14    .11E+060.      0.      0.      0.      0.      0.      0.      0.      0.
   13   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   12   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   11   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   10   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    9   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    8   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    7   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    6   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    5   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    4   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    3   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    2   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    1   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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5.00KM GRID OF TOT  HC  EMISSIONS IN G/HR FOR AREA= DENVE ALT=HI NONCAL  YEAR=1982 SEASON=1 DAY=7 HOUR=1200 TEMP=20.F

NORTH   GRIDS EAST--
GRIDS      1         2         3         4         5         6         7         8         9        10        11        12        13        14        15
  25    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
  24    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
  23    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
  22    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
  21    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
  20    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
  19    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
  18    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
  17    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
  16    0.        0.        0.        0.        .11E+060.           0.        0.        0.        0.        0.        0.        0.        0.        0.
  15    0.        0.        0.        0.        .18E+060.           0.        0.        0.        0.        0.        0.        0.        0.        0.
  14    0.        0.        0.        0.        .16E+06   .10E+06   .76E+05   .70E+05   .79E+05   .62E+05   .36E+05   .20E+050.           0.        .27E+06
  13    0.        0.        0.        0.        .19E+05   .10E+06   .83E+04   .60E+05   .52E+05   .48E+05   .57E+05   .13E+06   .60E+05   .23E+06   .21E+06
  12    0.        0.        0.        .14E+05   .52E+05   .47E+05   .21E+04   .70E+05   .12E+06   .12E+06   .68E+05   .90E+05   .34E+06   .26E+060.
  11    0.        0.        .29E+05   .99E+05   .15E+06   .90E+05   .15E+06   .22E+06   .17E+06   .18E+06   .17E+06   .27E+06   .17E+060.           0.
  10    0.        .31E+05   .11E+05   .26E+05   .21E+06   .96E+05   .92E+05   .13E+06   .62E+05   .21E+06   .25E+06   .33E+06   .14E+050.           0.
   9    0.        .27E+05   .56E+05   .60E+05   .15E+06   .53E+05   .34E+05   .54E+05   .62E+05   .56E+05   .19E+06   .41E+06   .15E+050.           0.
   8    0.        .48E+05   .97E+05   .27E+05   .72E+05   .34E+05   .27E+05   .47E+05   .67E+04   .48E+05   .32E+05   .40E+06   .67E+040.           0.
   7    0.        .39E+05   .11E+050.           .68E+05   .35E+05   .62E+05   .82E+05   .16E+05   .60E+05   .27E+05   .48E+06   .56E+050.           0.
   6    0.        .28E+05   .21E+05   .29E+05   .16E+06   .58E+05   .15E+05   .41E+05   .41E+05   .40E+05   .43E+06   .12E+06   .11E+06   .45E+050.
   5    0.        .74E+04   .31E+05   .33E+05   .15E+06   .23E+05   .34E+05   .18E+06   .31E+06   .25E+06   .31E+06   .35E+06   .77E+04   .59E+030.
   4    0.        .26E+04   .90E+04   .28E+04   .13E+06   .19E+04   .82E+05   .19E+06   .54E+050.           0.        .34E+06   .16E+040.           0.
   3    0.        0.        .99E+04   .53E+04   .14E+06   .17E+06   .23E+06   .73E+05   .33E+05   .96E+040.           .32E+060.           0.        0.
   2    0.        0.        .19E+03   .73E+03   .82E+05   .51E+05   .30E+050.           0.        .23E+05   .45E+05   .58E+050.           0.        0.
   1    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.

NORTH   GRIDS EAST--
GRIDS     16        17        18        19        20        21        22        23        24        25
  25    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
  24    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
  23    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
  22    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
  21    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
  20    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
  19    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
  18    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
  17    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
  16    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
  15    .18E+06   .15E+060.           0.        0.        0.        0.        0.        0.        0.
  14    .18E+060.           0.        0.        0.        0.        0.        0.        0.        0.
  13    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
  12    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
  11    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
  10    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   9    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   8    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   7    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   6    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   5    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   4    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   3    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   2    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   1    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
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5.00KM GRID OF PRI  CO  EMISSIONS IN G/HR FOR AREA= DENVE ALT=HI NONCAL  YEAR=1982 SEASON=1 DAY=7 HOUR=1200 TEMP=20.F

NORTH    GRIDS EAST--
GRIDS         1        2        3        4        5        6        7        8        9       10       11       12       13       14       15
   25    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
   24    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
   23    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
   22    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
   21    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
   20    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
   19    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
   18    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
   17    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
   16    0.       0.       0.       0.         .31E+060.       0.       0.       0.       0.       0.       0.       0.       0.       0.
   15    0.       0.       0.       0.         .50E+060.       0.       0.       0.       0.       0.       0.       0.       0.       0.
   14    0.       0.       0.       0.         .58E+06  .38E+06  .29E+06  .26E+06  .30E+06  .26E+06  .16E+06  .83E+050.       0.         .10E+07
   13    0.       0.       0.       0.         .72E+05  .38E+06  .30E+05  .22E+06  .20E+06  .25E+06  .31E+06  .71E+06  .27E+06  .85E+06  .77E+06
   12    0.       0.       0.         .51E+05  .20E+06  .18E+06  .90E+04  .31E+06  .54E+06  .62E+06  .42E+06  .56E+06  .14E+07  .96E+060.
   11    0.       0.         .11E+06  .37E+06  .60E+06  .41E+06  .66E+06  .10E+07  .83E+06  .11E+07  .11E+07  .14E+07  .92E+060.       0.
   10    0.         .12E+06  .39E+05  .96E+05  .81E+06  .39E+06  .39E+06  .57E+06  .29E+06  .11E+07  .12E+07  .14E+07  .52E+050.       0.
    9    0.         .98E+05  .21E+06  .23E+06  .57E+06  .21E+06  .15E+06  .24E+06  .30E+06  .25E+06  .90E+06  .18E+07  .58E+050.       0.
    8    0.         .18E+06  .38E+06  .10E+06  .27E+06  .13E+06  .10E+06  .20E+06  .31E+05  .21E+06  .14E+06  .17E+07  .25E+050.       0.
    7    0.         .15E+06  .39E+050.         .26E+06  .13E+06  .23E+06  .31E+06  .71E+05  .27E+06  .11E+06  .18E+07  .21E+060.       0.
    6    0.         .10E+06  .77E+05  .11E+06  .60E+06  .21E+06  .56E+05  .15E+06  .15E+06  .16E+06  .16E+07  .44E+06  .42E+06  .17E+060.
    5    0.         .27E+05  .11E+06  .12E+06  .56E+06  .85E+05  .13E+06  .66E+06  .97E+06  .75E+06  .11E+07  .12E+07  .29E+05  .22E+040.
    4    0.         .98E+04  .34E+05  .99E+04  .50E+06  .70E+04  .28E+06  .59E+06  .20E+060.       0.         .11E+07  .61E+040.       0.
    3    0.       0.         .37E+05  .20E+05  .52E+06  .73E+06  .78E+06  .27E+06  .12E+06  .35E+050.         .10E+070.       0.       0.
    2    0.       0.         .72E+03  .28E+04  .36E+06  .20E+06  .11E+060.       0.         .83E+05  .16E+06  .18E+060.       0.       0.
    1    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.

NORTH    GRIDS EAST--
GRIDS        16       17       18       19       20       21       22       23       24       25
   25    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
   24    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
   23    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
   22    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
   21    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
   20    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
   19    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
   18    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
   17    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
   16    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
   15      .65E+06  .56E+060.       0.       0.       0.       0.       0.       0.       0.
   14      .66E+060.       0.       0.       0.       0.       0.       0.       0.       0.
   13    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
   12    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
   11    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
   10    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
    9    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
    8    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
    7    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
    6    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
    5    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
    4    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
    3    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
    2    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
    1    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
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5.00KM GRID OF SEC  CO  EMISSIONS IN G/HR FOR AREA= DENVE ALT=HI NONCAL  YEAR=1982 SEASON=1 DAY=7 HOUR=1200 TEMP=20.F

NORTH   GRIDS EAST--
GRIDS       1       2       3       4       5       6       7       8       9      10      11      12      13      14      15
   25   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   24   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   23   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   22   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   21   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   20   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   19   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   18   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   17   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   16   0.      0.      0.      0.       .72E+060.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   15   0.      0.      0.      0.       .12E+070.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   14   0.      0.      0.      0.       .92E+06 .56E+06 .42E+06 .38E+06 .43E+06 .31E+06 .17E+06 .10E+060.      0.       .15E+07
   13   0.      0.      0.      0.       .10E+06 .56E+06 .47E+05 .33E+06 .29E+06 .20E+06 .21E+06 .51E+06 .29E+06 .13E+07 .11E+07
   12   0.      0.      0.       .74E+05 .28E+06 .26E+06 .10E+05 .34E+06 .58E+06 .45E+06 .20E+06 .26E+06 .17E+07 .14E+070.
   11   0.      0.       .16E+06 .55E+06 .75E+06 .43E+06 .70E+06 .10E+07 .78E+06 .56E+06 .49E+06 .11E+07 .63E+060.      0.
   10   0.       .17E+06 .59E+05 .14E+06 .11E+07 .50E+06 .45E+06 .60E+06 .28E+06 .86E+06 .11E+07 .16E+07 .80E+050.      0.
    9   0.       .15E+06 .31E+06 .33E+06 .85E+06 .28E+06 .16E+06 .26E+06 .28E+06 .27E+06 .86E+06 .20E+07 .83E+050.      0.
    8   0.       .26E+06 .52E+06 .15E+06 .40E+06 .19E+06 .15E+06 .24E+06 .32E+05 .23E+06 .15E+06 .20E+07 .37E+050.      0.
    7   0.       .21E+06 .61E+050.       .38E+06 .19E+06 .34E+06 .45E+06 .76E+05 .29E+06 .14E+06 .26E+07 .31E+060.      0.
    6   0.       .15E+06 .11E+06 .16E+06 .89E+06 .32E+06 .85E+05 .23E+06 .22E+06 .21E+06 .23E+07 .67E+06 .64E+06 .25E+060.
    5   0.       .41E+05 .17E+06 .18E+06 .83E+06 .13E+06 .19E+06 .10E+07 .18E+07 .16E+07 .17E+07 .20E+07 .42E+05 .32E+040.
    4   0.       .14E+05 .49E+05 .16E+05 .75E+06 .10E+05 .47E+06 .12E+07 .30E+060.      0.       .20E+07 .88E+040.      0.
    3   0.      0.       .54E+05 .29E+05 .74E+06 .86E+06 .13E+07 .41E+06 .18E+06 .54E+050.       .19E+070.      0.      0.
    2   0.      0.       .11E+04 .40E+04 .42E+06 .27E+06 .17E+060.      0.       .13E+06 .25E+06 .35E+060.      0.      0.
    1   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

NORTH   GRIDS EAST--
GRIDS      16      17      18      19      20      21      22      23      24      25
   25   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   24   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   23   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   22   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   21   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   20   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   19   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   18   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   17   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   16   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   15    .98E+06 .86E+060.      0.      0.      0.      0.      0.      0.      0.
   14    .98E+060.      0.      0.      0.      0.      0.      0.      0.      0.
   13   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   12   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   11   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   10   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    9   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    8   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    7   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    6   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    5   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    4   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    3   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    2   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    1   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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5.00KM GRID OF TOT  CO  EMISSIONS IN G/HR FOR AREA= DENVE ALT=HI NONCAL  YEAR=1982 SEASON=1 DAY=7 HOUR=1200 TEMP=20.F

NORTH    GRIDS EAST--
GRIDS      1         2         3         4         5         6         7         8         9        10        11        12        13        14        15
   25     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   24     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   23     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   22     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   21     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   20     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   19     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   18     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   17     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   16     0.        0.        0.        0.       .10E+070.            0.        0.        0.        0.        0.        0.        0.        0.        0.
   15     0.        0.        0.        0.       .17E+070.            0.        0.        0.        0.        0.        0.        0.        0.        0.
   14     0.        0.        0.        0.       .15E+07   .95E+06   .71E+06   .64E+06   .73E+06   .57E+06   .33E+06   .19E+060.            0.       .25E+07
   13     0.        0.        0.        0.       .18E+06   .94E+06   .77E+05   .55E+06   .48E+06   .44E+06   .52E+06   .12E+07   .56E+06   .21E+07   .19E+07
   12     0.        0.        0.       .13E+06   .48E+06   .43E+06   .19E+05   .65E+06   .11E+07   .11E+07   .62E+06   .82E+06   .31E+07   .24E+070.
   11     0.        0.       .27E+06   .92E+06   .14E+07   .84E+06   .14E+07   .21E+07   .16E+07   .17E+07   .16E+07   .25E+07   .16E+070.            0.
   10     0.       .29E+06   .98E+05   .24E+06   .19E+07   .89E+06   .85E+06   .12E+07   .57E+06   .19E+07   .23E+07   .30E+07   .13E+060.            0.
    9     0.       .25E+06   .52E+06   .55E+06   .14E+07   .49E+06   .32E+06   .50E+06   .58E+06   .52E+06   .18E+07   .38E+07   .14E+060.            0.
    8     0.       .45E+06   .90E+06   .25E+06   .67E+06   .31E+06   .25E+06   .44E+06   .62E+05   .45E+06   .29E+06   .37E+07   .62E+050.            0.
    7     0.       .36E+06   .99E+050.           .63E+06   .32E+06   .57E+06   .76E+06   .15E+06   .56E+06   .25E+06   .44E+07   .52E+060.            0.
    6     0.       .26E+06   .19E+06   .27E+06   .15E+07   .53E+06   .14E+06   .38E+06   .37E+06   .37E+06   .39E+07   .11E+07   .11E+07   .42E+060.
    5     0.       .68E+05   .29E+06   .30E+06   .14E+07   .21E+06   .32E+06   .17E+07   .28E+07   .23E+07   .28E+07   .32E+07   .71E+05   .54E+040.
    4     0.       .24E+05   .83E+05   .25E+05   .12E+07   .17E+05   .75E+06   .17E+07   .50E+060.            0.       .31E+07   .15E+050.            0.
    3     0.        0.       .91E+05   .49E+05   .13E+07   .16E+07   .21E+07   .68E+06   .30E+06   .89E+050.           .30E+070.            0.        0.
    2     0.        0.       .18E+04   .67E+04   .79E+06   .47E+06   .28E+060.            0.       .21E+06   .41E+06   .53E+060.            0.        0.
    1     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.

NORTH    GRIDS EAST--
GRIDS     16        17        18        19        20        21        22        23        24        25
   25     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   24     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   23     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   22     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   21     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   20     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   19     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   18     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   17     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   16     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   15    .16E+07   .14E+070.            0.        0.        0.        0.        0.        0.        0.
   14    .16E+070.            0.        0.        0.        0.        0.        0.        0.        0.
   13     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   12     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   11     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   10     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
    9     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
    8     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
    7     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
    6     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
    5     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
    4     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
    3     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
    2     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
    1     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
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5.00KM GRID OF PRI  NOX EMISSIONS IN G/HR FOR AREA= DENVE ALT=HI NONCAL  YEAR=1982 SEASON=1 DAY=7 HOUR=1200 TEMP=20.F

NORTH   GRIDS EAST--
GRIDS     1       2       3       4       5       6       7       8       9      10      11      12      13      14      15
  25    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  24    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  23    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  22    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  21    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  20    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  19    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  18    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  17    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  16    0.      0.      0.      0.       .68E+040.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  15    0.      0.      0.      0.       .11E+050.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  14    0.      0.      0.      0.       .93E+04 .59E+04 .44E+04 .40E+04 .46E+04 .39E+04 .25E+04 .13E+040.      0.       .16E+05
  13    0.      0.      0.      0.       .11E+04 .58E+04 .46E+03 .34E+04 .31E+04 .40E+04 .50E+04 .10E+05 .42E+04 .13E+05 .12E+05
  12    0.      0.      0.       .79E+03 .31E+04 .27E+04 .14E+03 .48E+04 .84E+04 .97E+04 .70E+04 .92E+04 .22E+05 .15E+050.
  11    0.      0.       .17E+04 .57E+04 .93E+04 .63E+04 .10E+05 .16E+05 .13E+05 .17E+05 .17E+05 .21E+05 .15E+050.      0.
  10    0.       .18E+04 .60E+03 .15E+04 .12E+05 .61E+04 .61E+04 .88E+04 .46E+04 .17E+05 .18E+05 .22E+05 .80E+030.      0.
   9    0.       .15E+04 .32E+04 .35E+04 .88E+04 .32E+04 .24E+04 .37E+04 .47E+04 .39E+04 .14E+05 .28E+05 .90E+030.      0.
   8    0.       .27E+04 .56E+04 .15E+04 .41E+04 .20E+04 .15E+04 .30E+04 .47E+03 .33E+04 .22E+04 .27E+05 .38E+030.      0.
   7    0.       .22E+04 .59E+030.       .39E+04 .20E+04 .35E+04 .48E+04 .11E+04 .42E+04 .17E+04 .27E+05 .32E+040.      0.
   6    0.       .16E+04 .12E+04 .17E+04 .92E+04 .33E+04 .86E+03 .23E+04 .23E+04 .25E+04 .25E+05 .68E+04 .65E+04 .26E+040.
   5    0.       .41E+03 .18E+04 .19E+04 .85E+04 .13E+04 .20E+04 .11E+05 .18E+05 .15E+05 .18E+05 .20E+05 .45E+03 .34E+020.
   4    0.       .15E+03 .52E+03 .15E+03 .77E+04 .11E+03 .48E+04 .11E+05 .31E+040.      0.       .19E+05 .94E+020.      0.
   3    0.      0.       .57E+03 .31E+03 .76E+04 .92E+04 .13E+05 .41E+04 .18E+04 .54E+030.       .19E+050.      0.      0.
   2    0.      0.       .11E+02 .43E+02 .45E+04 .30E+04 .17E+040.      0.       .13E+04 .25E+04 .34E+040.      0.      0.
   1    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

NORTH   GRIDS EAST--
GRIDS    16      17      18      19      20      21      22      23      24      25
  25    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  24    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  23    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  22    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  21    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  20    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  19    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  18    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  17    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  16    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  15     .10E+05 .87E+040.      0.      0.      0.      0.      0.      0.      0.
  14     .10E+050.      0.      0.      0.      0.      0.      0.      0.      0.
  13    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  12    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  11    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  10    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   9    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   8    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   7    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   6    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   5    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   4    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   3    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   2    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   1    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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5.00KM GRID OF SEC  NOX EMISSIONS IN G/HR FOR AREA= DENVE ALT=HI NONCAL  YEAR=1982 SEASON=1 DAY=7 HOUR=1200 TEMP=20.F

NORTH   GRIDS EAST--
GRIDS        1       2       3       4       5       6       7       8       9      10      11      12      13      14       1
   25   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   24   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   23   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   22   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   21   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   20   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   19   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   18   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   17   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   16   0.      0.      0.      0.       .14E+050.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   15   0.      0.      0.      0.       .22E+050.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   14   0.      0.      0.      0.       .17E+05 .11E+05 .79E+04 .72E+04 .81E+04 .59E+04 .33E+04 .19E+040.      0.       .29
   13   0.      0.      0.      0.       .20E+04 .11E+05 .89E+03 .63E+04 .54E+04 .37E+04 .40E+04 .97E+04 .54E+04 .24E+05 .22
   12   0.      0.      0.       .14E+04 .53E+04 .49E+04 .19E+03 .64E+04 .11E+05 .85E+04 .37E+04 .49E+04 .32E+05 .27E+050.
   11   0.      0.       .30E+04 .10E+05 .14E+05 .81E+04 .13E+05 .20E+05 .15E+05 .11E+05 .93E+04 .20E+05 .12E+050.      0.
   10   0.       .33E+04 .11E+04 .27E+04 .21E+05 .94E+04 .86E+04 .11E+05 .52E+04 .16E+05 .21E+05 .30E+05 .15E+040.      0.
    9   0.       .28E+04 .58E+04 .62E+04 .16E+05 .54E+04 .31E+04 .48E+04 .53E+04 .52E+04 .16E+05 .38E+05 .16E+040.      0.
    8   0.       .50E+04 .95E+04 .28E+04 .75E+04 .35E+04 .28E+04 .46E+04 .60E+03 .44E+04 .28E+04 .38E+05 .69E+030.      0.
    7   0.       .40E+04 .11E+040.       .71E+04 .36E+04 .65E+04 .84E+04 .14E+04 .55E+04 .26E+04 .50E+05 .58E+040.      0.
    6   0.       .29E+04 .21E+04 .31E+04 .17E+05 .60E+04 .16E+04 .43E+04 .42E+04 .39E+04 .44E+05 .13E+05 .12E+05 .47E+040.
    5   0.       .78E+03 .32E+04 .35E+04 .16E+05 .24E+04 .36E+04 .19E+05 .34E+05 .29E+05 .33E+05 .38E+05 .79E+03 .60E+020.
    4   0.       .27E+03 .53E+03 .29E+03 .14E+05 .20E+03 .89E+04 .22E+05 .57E+040.      0.       .38E+05 .17E+030.      0.
    3   0.      0.       .10E+04 .55E+03 .14E+05 .16E+05 .25E+05 .77E+04 .35E+04 .10E+040.       .36E+050.      0.      0.
    2   0.      0.       .20E+02 .75E+02 .80E+04 .51E+04 .31E+040.      0.       .24E+04 .47E+04 .66E+040.      0.      0.
    1   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

NORTH   GRIDS EAST--
GRIDS       16      17      18      19      20      21      22      23      24      25
   25   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   24   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   23   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   22   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   21   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   20   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   19   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   18   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   17   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   16   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   15    .19E+05 .16E+050.      0.      0.      0.      0.      0.      0.      0.
   14    .19E+050.      0.      0.      0.      0.      0.      0.      0.      0.
   13   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   12   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   11   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   10   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    9   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    8   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    7   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    6   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    5   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    4   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    3   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    2   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    1   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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5.00KM GRID OF TOT  NOX EMISSICNS IN G/HR FCR AREA= DENVE ALT=HI NONCAL  YEAR=1982 SEASON=1 DAY=7 HOUR=1200 TEMP=20.F
NORTH   GRIDS EAST--
GRIDS         1       2       3       4       5       6       7       8       9      10      11      12      13      14      15
  25    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  24    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  23    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  22    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  21    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  20    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  19    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  18    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  17    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  16    0.      0.      0.      0.       .20E+050.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  15    0.      0.      0.      0.       .33E+050.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  14    0.      0.      0.      0.       .27E+05 .17E+05 .12E+05 .11E+05 .13E+05 .99E+04 .57E+04 .32E+040.      0.       .44E+05
  13    0.      0.      0.      0.       .31E+04 .16E+05 .13E+04 .97E+04 .85E+04 .77E+04 .90E+04 .20E+05 .95E+04 .37E+05 .34E+05
  12    0.      0.      0.       .22E+04 .84E+04 .76E+04 .33E+03 .11E+05 .19E+05 .18E+05 .11E+05 .14E+05 .54E+05 .42E+050.
  11    0.      0.       .47E+04 .16E+05 .24E+05 .14E+05 .23E+05 .36E+05 .27E+05 .28E+05 .27E+05 .42E+05 .27E+050.      0.
  10    0.       .51E+04 .17E+04 .42E+04 .33E+05 .15E+05 .15E+05 .20E+05 .98E+04 .34E+05 .39E+05 .52E+05 .23E+040.      0.
   9    0.       .43E+04 .90E+04 .96E+04 .25E+05 .86E+04 .54E+04 .85E+04 .10E+05 .90E+04 .30E+05 .66E+05 .25E+040.      0.
   8    0.       .77E+04 .15E+05 .43E+04 .12E+05 .55E+04 .43E+04 .76E+04 .11E+04 .77E+04 .50E+04 .64E+05 .11E+040.      0.
   7    0.       .62E+04 .17E+040.       .11E+05 .56E+04 .10E+05 .13E+05 .25E+04 .97E+04 .43E+04 .77E+05 .90E+040.      0.
   6    0.       .45E+04 .33E+04 .48E+04 .26E+05 .93E+04 .25E+04 .66E+04 .65E+04 .64E+04 .69E+05 .19E+05 .19E+05 .73E+040.
   5    0.       .12E+04 .50E+04 .53E+04 .24E+05 .37E+04 .56E+04 .30E+05 .52E+05 .44E+05 .50E+05 .58E+05 .12E+04 .95E+020.
   4    0.       .42E+03 .14E+04 .44E+03 .22E+05 .30E+03 .14E+05 .33E+05 .87E+040.      0.       .57E+05 .26E+030.      0.
   3    0.      0.       .16E+04 .86E+03 .22E+05 .25E+05 .38E+05 .12E+05 .53E+04 .16E+040.       .55E+050.      0.      0.
   2    0.      0.       .31E+02 .12E+03 .13E+05 .81E+04 .48E+040.      0.       .37E+04 .72E+04 .10E+050.      0.      0.
   1    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
NORTH   GRIDS EAST--
GRIDS        16      17      18      19      20      21      22      23      24      25
  25    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  24    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  23    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  22    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  21    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  20    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  19    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  18    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  17    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  16    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  15     .29E+05 .25E+050.      0.      0.      0.      0.      0.      0.      0.
  14     .29E+050.      0.      0.      0.      0.      0.      0.      0.      0.
  13    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  12    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  11    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  10    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   9    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   8    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   7    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   6    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   5    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   4    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   3    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   2    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   1    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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APRAC-3 INPUTS: PROBLEM 4

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CARD      10        20        30        40        50        60        70        80
NO..........+.........+.........+.........+.........+.........+.........+.........+
 1 1 PRINT INPUTS                                    YES
 2 2 PRINT GRIDDED  PRIMARY EMISSIONS                YES
 3 3 PRINT GRIDDED SECONDARY EMISSIONS               YES
 4 4 PRINT GRIDDED TOTAL EMISSIONS                   YES
 5 5 PRINT TRAFFIC LINK FILE                         NO        NO
 6 6 CALCULATE FOR HC-CO-NOX                         YES       NO        NO
 7 7 USE DIFFUSION MODEL                             YES
 8 8 2ND TRAF AUTO/BIG TRF/MINVMT                    YES  YES       40000.      0
 9 9 USE CAPACITY RESTRAINT FOR SPEEDS               YES
10 10 IS HOURLY VOLUME INPUT                         YES
11 11 ARE TRAFFIC INPUTS IN FHWA FORMAT              YES
12 12 ARE SPEEDS SPECIFIED FOR EACH LINK             NO
13 13 AREA IDENTIFIER                                DENVER
14 14 ALTITUDE CATEGORY                              HIGH
15 15 CALIF. CONTROLS                                NO
16 16 NO.E-W/N-S GRID SQUARES--GRID SIZE KM<           25        25      5.
17 17 ORIGIN COORD. IN TRAFFIC SYSTEM<CONVER.FACTOR     41500.0   44000.0   0.01609
18 0.015     0.008     0.006     0.004     0.004     0.007     0.027     0.061
19 0.052     0.040     0.05      0.059     0.078     0.081     0.070     0.066
20 0.077     0.072     0.049     0.043     0.047     0.036     0.026     0.021
21 0.013     0.006     0.003     0.004     0.002     0.003     0.017     0.035
22 0.036     0.039     0.048     0.067     0.104     0.068     0.070     0.071
23 0.095     0.081     0.057     0.048     0.046     0.039     0.028     0.020
24 0.008     0.004     0.003     0.002     0.002     0.007     0.036     0.101
25 0.081     0.051     0.052     0.057     0.064     0.066     0.061     0.065
26 0.068     0.052     0.052     0.052     0.045     0.028     0.025     0.018
27 0.014     0.007     0.005     0.003     0.002     0.002     0.010     0.031
28 0.041     0.038     0.046     0.055     0.068     0.06      0.064     0.073
29 0.097     0.121     0.081     0.058     0.035     0.038     0.031     0.019
30 0.006     0.003     0.002     0.002     0.003     0.015     0.078     0.149
31 0.077     0.059     0.052     0.051     0.052     0.049     0.050     0.071
32 0.056     0.052     0.055     0.043     0.021     0.017     0.017     0.011
33 0.021     0.01      0.005     0.003     0.002     0.003     0.009     0.033
34 0.036     0.034     0.04      0.053     0.056     0.060     0.063     0.074
35 0.112     0.136     0.079     0.046     0.038     0.040     0.029     0.02
36 0.01      0.004     0.004     0.002     0.005     0.018     0.066     0.103
37 0.079     0.061     0.057     0.057     0.056     0.056     0.061     0.062
38 0.079     0.065     0.054     0.031     0.019     0.018     0.016     0.016
39 0.015     0.007     0.005     0.004     0.002     0.004     0.024     0.086
40 0.057     0.049     0.051     0.053     0.057     0.064     0.067     0.074
41 0.099     0.079     0.052     0.036     0.032     0.039     0.027     0.019
42 0.007     0.002     0.002     0.001     0.001     0.012     0.056     0.161
43 0.091     0.058     0.058     0.055     0.045     0.052     0.062     0.066
44 0.064     0.059     0.054     0.032     0.017     0.012     0.019     0.015
45 0.016     0.009     0.005     0.002     0.004     0.003     0.017     0.054
46 0.046     0.037     0.051     0.052     0.048     0.051     0.057     0.073
47 0.127     0.125     0.063     0.035     0.030     0.040     0.031     0.022
48 0.014     0.007     0.004     0.004     0.006     0.016     0.062     0.097
49 0.075     0.052     0.051     0.054     0.049     0.056     0.063     0.067
50 0.072     0.064     0.047     0.039     0.027     0.027     0.026     0.022
51 0.017     0.010     0.006     0.004     0.004     0.007     0.022     0.057
52 0.055     0.044     0.044     0.050     0.057     0.053     0.059     0.078
53 0.110     0.099     0.060     0.045     0.033     0.035     0.028     0.024
54 0.013     0.004     0.004     0.002     0.003     0.005     0.033     0.127
55 0.13      0.066     0.048     0.043     0.047     0.042     0.045     0.051
56 0.07      0.073     0.056     0.042     0.031     0.026     0.020     0.017
57 0.012     0.006     0.004     0.001     0.001     0.005     0.026     0.079
58 0.086     0.049     0.039     0.040     0.043     0.046     0.052     0.071
59 0.091     0.103     0.074     0.048     0.035     0.033     0.029     0.025
60 0.007     0.003     0.002     0.001     0.0       0.009     0.077     0.175
61 0.131     0.056     0.045     0.041     0.039     0.042     0.041     0.057
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CARD         10        20        30        40        50        60        70        80
 NO.........+.........+.........+.........+.........+.........+.........+.........+
  62 0.059     0.059     0.045     0.032     0.023     0.021     0.023     0.013
  63 0.017     0.005     0.003     0.001     0.001     0.001     0.009     0.041
  64 0.049     0.034     0.032     0.034     0.035     0.035     0.043     0.070
  65 0.163     0.181     0.101     0.051     0.028     0.024     0.025     0.017
  66 0.009     0.006     0.004     0.003     0.005     0.011     0.055     0.094
  67 0.072     0.059     0.032     0.058     0.054     0.058     0.059     0.07
  68 0.083     0.068     0.051     0.039     0.033     0.034     0.023     0.018
  69 0.012     0.006     0.004     0.003     0.004     0.008     0.047     0.069
  70 0.053     0.052     0.055     0.056     0.052     0.061     0.063     0.073
  71 0.088     0.097     0.067     0.041     0.029     0.026     0.018     0.019
  72 0.011     0.006     0.005     0.004     0.007     0.023     0.110     0.117
  73 0.083     0.061     0.054     0.049     0.045     0.046     0.05      0.05
  74 0.065     0.058     0.042     0.037     0.021     0.019     0.021     0.017
  75 0.022     0.011     0.007     0.005     0.005     0.007     0.019     0.053
  76 0.045     0.045     0.045     0.047     0.043     0.05      0.053     0.07
  77 0.099     0.101     0.095     0.045     0.036     0.039     0.033     0.025
  78 0.012     0.004     0.0025    0.001     0.0005    0.0095    0.043     0.108
  79 0.09      0.045     0.0385    0.0375    0.037     0.0385    0.042     0.0635
  80 0.111     0.12      0.073     0.0425    0.0255    0.0225    0.024     0.015
  81 0.03      0.028     0.011     0.008     0.006     0.007     0.012     0.018
  82 0.024     0.033     0.034     0.041     0.042     0.041     0.038     0.037
  83 0.038     0.039     0.032     0.028     0.028     0.035     0.036     0.034
  84 0.03      0.028     0.011     0.008     0.006     0.007     0.012     0.018
  85 0.024     0.033     0.034     0.041     0.042     0.041     0.038     0.037
  86 0.038     0.039     0.032     0.028     0.028     0.035     0.036     0.034
  87 0.028     0.020     0.011     0.007     0.004     0.003     0.005     0.005
  88 0.01      0.011     0.014     0.02      0.023     0.023     0.025     0.025
  89 0.024     0.024     0.023     0.02      0.019     0.019     0.017     0.015
  90 0.01      0.011     0.014     0.02      0.023     0.023     0.025     0.025
  91 0.024     0.024     0.023     0.02      0.019     0.019     0.017     0.015
  92 0.028     0.020     0.011     0.007     0.004     0.003     0.005     0.005
  93 0.028     0.020     0.011     0.007     0.004     0.003     0.005     0.005
  94 0.01      0.011     0.014     0.02      0.023     0.023     0.025     0.025
  95 0.024     0.024     0.023     0.02      0.019     0.019     0.017     0.015
  96 0.028     0.020     0.011     0.007     0.004     0.003     0.005     0.005
  97 0.01      0.011     0.014     0.02      0.023     0.023     0.025     0.025
  98 0.024     0.024     0.023     0.02      0.019     0.019     0.017     0.015
  99     1.        1.        1.        1.
 100       19.8
 101 50.0    55.0    55.0    55.0    55.0    10.0    22.0    12.0    12.0    45.0
 102   10000.   2500.
 103       10.      25.      35.      25.      10.
 104 20000000.
 105 1982   1   7  12      20.       STOP
 106 LAT.POP.CENTER CITY                     38.6 2.36  31.5 40.5
 107 NO. OF RECEPTORS                          1
 108 XR/YR  1 31.   31.
 109 NO. OF WIND INPUTS                        1
 110 X.Y-W  1 32.0  33.0
 111 LONG RUN/ST. CANYON/INTERSECTION        NO        NO        NO
 112 HOLIDAYS
 113 1ST AND LAST HOUR                          18   18
 114 POLLUTANT                               HC
 115 UPWIND BACKGROUND -NNE THRU S            600. 700. 500. 500. 400. 300. 250. 300.
 116 UPWIND BACKGROUND  SSW THRU N            400. 450. 500. 200. 550. 450. 500. 500.
 117 DIRECT INPUT OF MIXING DEPTH            NO
 118 DENVER         820826   84   58
 119 03879710826120102 -   0158095001740    09930              230002
 120 03879710826120203 -   0183094002090    09890              251002
 121 03879710826120304 -   0215048002790    09810              264003
 122 03879710826120405 -   0226032003140    09770              267003
 123 03879710826120506 -   0219029005940    09460              295005
 124 03879710826120607 -   0154031015110    08500              301007
 125 03879710826120708 -   0097031022000    07830              310011
 126 03879710826120809 -   0076005027900    07290              290014
 127 03879710826120910 -   0055010031230    07000              290017
```

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CARD       10        20        30        40        50        60        70        80
 NO.........+.........+.........+.........+.........+.........+.........+.........+
128 03879710826121011 -    0020004039780   06300               292017
129 03879710826121112 -   -0950030580 20   05000               302017
130           0    0   68         0    0
131           1    0   66        27    4
132           2    0   66        26    4
133           3    0   65        33   16
134           4    0   64        27    4
135           5    0   61        27    4
136 710826    6    0   61   58   36   04
137 710826    7    0   65   60    3   05
138 710826    8    0   68   60    6   10
139 710826    9    0   72   59    9   05
140 710826   10    0   76   59   12   05
141 710826   11    0   79   59   15   05
142 710826   12    0   81   58   18   10
143 710826   13    1   82   59   21   13
144 710826   14    1   83   56   24   14
145 710826   15    1   84   54   27   14
146 710826   16    1   82   55   30   09
147 710826   17    0   80   56   33    5
148 710826   18    0   76   57   34   13
149 710826   19    0   71   56   36   10
150 710826   20    0   68   56   01   09
151 710826   21    0   64   56   02   08
152 710826   22    0   61   56   01   07
153 710826   23    0   60   56   36   07
154  DENVER          820827   76   53
155  03879710827120102 -    0119097001740   09965               350002
156  03879710827120203 -    0144096003230   09790               011004
157  03879710827120304 -    0132073007750   09280               012005
158  03879710827120405 -    0106084011920   08830               347006
159  03879710827120506 -    0104054015100   08500               331007
160  03879710827120607 -    0113030017190   08290               327007
161  03879710827120708 -    0068020026370   07420               316010
162  03879710827120809 -    0075006027940   07280               313009
163  03879710827120910 -    0061009031160   07000               319008
164  03879710827121011 -    0050009036210   06580               329014
165  03879710827121112 -    0025008041820   06140               328019
166  03879710827121213 -   -0370090498 90   05550               332018
167  03879710827121314 -   -0780060580 60   05000               335020
168  710827    0    0   58   55   03   04
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PRINT INPUTS- YES
PRIMARY, SECCNDARY, AND/CR TOTAL TRAFFIC GRICS TC BE PRINTED-YES, YES, YES
PRINT LINK FILE-BEFORE NO
PRINT LINK FILE-AFTER NO
POLLUTANTS TO BE CONSIDERED- HC, YES - CO, NO  - NOX, NO
DIFFUSION MODEL TO BE USED- YES
AUTOMATIC COMPUTATION OF SECONDARY TRAFFIC- YES
ONLY BIG LINKS CONSIDERED  YES
MINIMUM VOLUME INCLUDED         40000.0
MAXIMUM LINKS INCLUDED  .            0
SPEEDS FROM CAPACITY RESTRAINT-  YES
HOURLY TRAFFIC VOLUMES U SED (AS OPPOSED TO ADT) -YES
FHWA TRAFFIC- YES
SPEED SPECIFIED FOR NON-FHWA DATA- NO
AREA DENVE IS HI ALTITUDE---CALIF.= NO
   5.000-KM. SQ. GRIDS--  25 IN E-W DIRECTION AND 25 N-S
THE ORIGIN OF THE GRID SYSTEM IS  41500.000, 44000.000(0.01 MILE UNITS--TRAFFIC COORD. SYSTEM)
TO CONVERT 0.01-MILE TO KM., MULTIPLY BY     .016090

DIURNAL TRAFFIC CYCLES, PRIMARY--
                                              .0150   .0080   .0060   .0040   .0040   .0070   .0270   .0610
   DIRECTION 1.LOCATION CODE = 1.FRACTICN/HR  .0520   .0400   .0500   .0590   .0780   .0810   .0700   .0660
                                              .0770   .0720   .0490   .0430   .0470   .0360   .0260   .0210

                                              .0130   .0060   .0030   .0040   .0020   .0030   .0170   .0350
   DIRECTION 2.LOCATION CODE = 1.FRACTICN/HR  .0360   .0390   .0480   .0670   .1040   .0680   .0700   .0710
                                              .0950   .0810   .0570   .0480   .0460   .0390   .0280   .0200

                                              .0080   .0040   .0030   .0020   .0020   .0070   .0360   .1010
   DIRECTION 1.LOCATION CODE = 2.FRACTION/HR  .0810   .0510   .0520   .0570   .0640   .0660   .0610   .0650
                                              .0680   .0520   .0520   .0520   .0450   .0280   .0250   .0180

                                              .0140   .0070   .0050   .0030   .0020   .0020   .0100   .0310
   DIRECTION 2.LOCATION CODE = 2.FRACTION/HR  .0410   .0380   .0460   .0550   .0680   .0600   .0640   .0730
                                              .0970   .1210   .0810   .0580   .0350   .0380   .0310   .0190

                                              .0060   .0030   .0020   .0020   .0030   .0150   .0780   .1490
   DIRECTION 1.LOCATION CODE = 3.FRACTICN/HR  .0770   .0590   .0520   .0510   .0520   .0490   .0500   .0710
                                              .0560   .0520   .0550   .0430   .0210   .0170   .0170   .0110

                                              .0210   .0100   .0050   .0030   .0020   .0030   .0090   .0330
   DIRECTION 2.LOCATION CODE = 3.FRACTICN/HR  .0360   .0340   .0400   .0530   .0560   .0600   .0630   .0740
                                              .1120   .1360   .0790   .0460   .0380   .0400   .0290   .0200

                                              .0100   .0040   .0040   .0020   .0050   .0180   .0660   .1030
   DIRECTION 1.LOCATION CODE = 4.FRACTION/HR  .0790   .0610   .0570   .0570   .0560   .0560   .0610   .0620
                                              .0790   .0650   .0540   .0310   .0190   .0180   .0160   .0160

                                              .0150   .0070   .0050   .0040   .0020   .0040   .0240   .0860
   DIRECTION 2.LOCATION CODE = 4.FRACTICN/HR  .0570   .0490   .0510   .0530   .0570   .0640   .0670   .0740
                                              .0990   .0790   .0520   .0360   .0320   .0390   .0270   .0190

                                              .0070   .0020   .0020   .0010   .0010   .0120   .0560   .1610
   DIRECTION 1.LOCATION CODE = 5.FRACTICN/HR  .0910   .0580   .0580   .0550   .0450   .0520   .0620   .0660
                                              .0640   .0590   .0540   .0320   .0170   .0120   .0190   .0150

                                              .0160   .0090   .0050   .0020   .0040   .0030   .0170   .0540
   DIRECTION 2.LOCATION CODE = 5.FRACTION/HR  .0460   .0370   .0510   .0520   .0480   .0510   .0570   .0730
                                              .1270   .1250   .0630   .0350   .0300   .0400   .0310   .0220
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                                                .0140   .0070   .0040   .0040   .0060   .0160   .0620   .0970
DIRECTION 1.LOCATION CODE = 6.FRACTION/HR       .0750   .0520   .0510   .0540   .0490   .0560   .0630   .0670
                                                .0720   .0640   .0470   .0390   .0270   .0270   .0260   .0220

                                                .0170   .0100   .0060   .0040   .0040   .0070   .0220   .0570
DIRECTION 2.LOCATION CODE = 6.FRACTICN/HR       .0550   .0440   .0440   .0500   .0570   .0530   .0590   .0780
                                                .1100   .0590   .0600   .0450   .0330   .0350   .0280   .0240

                                                .0130   .0040   .0040   .0020   .0030   .0050   .0330   .1270
DIRECTION 1.LOCATION CODE = 7.FRACTICN/HR       .1300   .0660   .0480   .0430   .0470   .0420   .0450   .0510
                                                .0700   .0730   .0560   .0420   .0310   .0260   .0200   .0170

                                                .0120   .0060   .0040   .0010   .0010   .0050   .0260   .0790
DIRECTION 2.LOCATION CODE = 7.FRACTICN/HR       .0860   .0490   .0390   .0400   .0430   .0460   .0520   .0710
                                                .0910   .1030   .0740   .0480   .0350   .0330   .0290   .0250

                                                .0070   .0030   .0020   .0010  0.0000   .0090   .0770   .1750
DIRECTION 1.LOCATION CODE = 8.FRACTION/HR       .1310   .0560   .0450   .0410   .0390   .0420   .0410   .0570
                                                .0590   .0590   .0450   .0320   .0230   .0210   .0230   .0130

                                                .0170   .0050   .0030   .0010   .0010   .0010   .0090   .0410
DIRECTION 2.LOCATION CODE = 8.FRACTICN/HR       .0490   .0340   .0320   .0340   .0350   .0350   .0430   .0700
                                                .1630   .1810   .1010   .0510   .0280   .0240   .0250   .0170

                                                .0090   .0060   .0040   .0030   .0050   .0110   .0550   .0940
DIRECTION 1.LOCATION CODE = 9.FRACTICN/HR       .0720   .0590   .0320   .0580   .0540   .0580   .0590   .0700
                                                .0830   .0680   .0510   .0390   .0330   .0340   .0230   .0180

                                                .0120   .0060   .0040   .0030   .0040   .0080   .0470   .0690
DIRECTION 2.LOCATION CODE = 9.FRACTION/HR       .0530   .0520   .0550   .0560   .0520   .0610   .0630   .0730
                                                .0880   .0970   .0670   .0410   .0290   .0260   .0180   .0190

                                                .0110   .0060   .0050   .0040   .0070   .0230   .1100   .1170
DIRECTION 1.LOCATION CODE =10.FRACTICN/HR       .0830   .0610   .0540   .0490   .0450   .0460   .0500   .0500
                                                .0650   .0580   .0420   .0370   .0210   .0190   .0210   .0170

                                                .0220   .0110   .0070   .0050   .0050   .0070   .0190   .0530
DIRECTION 2.LOCATION CODE =10.FRACTICN/HR       .0450   .0450   .0450   .0470   .0430   .0500   .0530   .0700
                                                .0990   .1010   .0950   .0450   .0360   .0390   .0330   .0250

                                                .0120   .0040   .0025   .0010   .0005   .0095   .0430   .1080
DIRECTION 1.LOCATION CODE =11.FRACTION/HR       .0900   .0450   .0385   .0375   .0370   .0385   .0420   .0635
                                                .1110   .1200   .0730   .0425   .0255   .0225   .0240   .0150

                                                .0300   .0280   .0110   .0080   .0060   .0070   .0120   .0180
DIRECTION 2.LOCATION CODE =11.FRACTICN/HR       .0240   .0330   .0340   .0410   .0420   .0410   .0380   .0370
                                                .0380   .0390   .0320   .0280   .0280   .0350   .0360   .0340

                                                .0300   .0280   .0110   .0080   .0060   .0070   .0120   .0180
DIRECTION 1.LOCATION CODE =12.FRACTICN/HR       .0240   .0330   .0340   .0410   .0420   .0410   .0380   .0370
                                                .0380   .0390   .0320   .0280   .0280   .0350   .0360   .0340

                                                .0280   .0200   .0110   .0070   .0040   .0030   .0050   .0050
DIRECTION 2.LOCATION CODE =12.FRACTION/HR       .0100   .0110   .0140   .0200   .0230   .0230   .0250   .0250
                                                .0240   .0240   .0230   .0200   .0190   .0190   .0170   .0150
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SECONDARY--WEEKDAY, SATURDAY, SUNDAY--
                                             .0100   .0110   .0140   .0200   .0230   .0230   .0250   .0250
                                             .0240   .0240   .0230   .0200   .0190   .0190   .0170   .0150
                                             .0280   .0200   .0110   .0070   .0040   .0030   .0050   .0050

                                             .0280   .0200   .0110   .0070   .0040   .0030   .0050   .0050
                                             .0100   .0110   .0140   .0200   .0230   .0230   .0250   .0250
                                             .0240   .0240   .0230   .0200   .0190   .0190   .0170   .0150

                                             .0280   .0200   .0110   .0070   .0040   .0030   .0050   .0050
                                             .0100   .0110   .0140   .0200   .0230   .0230   .0250   .0250
                                             .0240   .0240   .0230   .0200   .0190   .0190   .0170   .0150

SEASONAL ADJUSTMENTS (WINTER, SPRING, SUMMER, FALL)  1.0000  1.0000  1.0000  1.0000
AVG. SPEED (MPH) OF SECONDARY TRAFFIC =    19.800

BASIC FREEWAY SPEEDS--5 LOCALES     50.0    55.0    55.0    55.0    55.0
  NON-FREEWAY SPEEDS--5-LOCALES     10.0    22.0    12.0    12.0    45.0

HOURLY SPEED ADJUSTMENTS--

DEFAULT CAPACITIES (VEHICLE/HR)--FREEWAY AND NON-FREEWAY,  10000.   2500.

TOTAL TRAFFIC IN AREA (VEH.-MI. DURING PERIOD OF INTEREST)=  20000000.

RELATIVE SECONDARY TRAFFIC BY LOCALE (CBD, SUBURB/CORE CITY COMMERCIAL, RESIDENT., INDUST., RURAL)--
                                     10.0         25.0                        35.0      25.0    10.0
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121 LINKS STORED WITH VMT GT   40000.00
 A1        B1        A2        B2        LEN     LANDUS      AREA       IFAC       VOL1      VOL2       CAP      LOCL

  24.        8.       24.       10.       0.       2          3          2         9700.    68800.     2800.      3          0.00
  57.       18.       57.       16.       0.       2          3          1        59300.        0.     5100.      3          0.00
  57.       18.       57.       19.       0.       2          3          1            0.    67500.     6900.      3          0.00
  58.       16.       57.       19.       0.       2          3          2        69400.        0.     6900.      3          0.00
  58.       16.       58.       13.       0.       2          3          2            0.    53200.     5100.      3          0.00
  57.       16.       58.       13.       0.       2          3          1        56200.        0.     6900.      3          0.00
  60.        9.       58.       13.       0.       2          3          1            0.    66800.     5100.      3          0.00
  60.        9.       58.       13.       0.       2          3          2        56800.        0.     5100.      3          0.00
  59.       33.       62.       30.       0.       2          3          2        20300.    22600.     2800.      3          0.00
  59.       33.       58.       33.       0.       2          3          2        22600.    21500.     2800.      3          0.00
  62.       30.       59.       26.       0.       2          3          2        30800.    11400.     2800.      3          0.00
  59.       26.       59.       26.       0.       2          3          2        33200.    15600.     2800.      3          0.00
  59.       26.       56.       23.       0.       2          3          2        40700.     4400.     2800.      3          0.00
  57.       19.       56.       22.       0.       2          3          2        46900.        0.     6900.      3          0.00
  57.       19.       56.       22.       0.       2          3          1            0.    56800.     6900.      3          0.00
  56.       22.       55.       23.       0.       2          3          2        40800.        0.     6900.      3          0.00
  56.       22.       55.       23.       0.       2          3          1            0.    54800.     5100.      3          0.00
  55.       23.       54.       27.       0.       2          3          2            0.    70700.     6900.      3          0.00
  55.       23.       54.       27.       0.       2          3          2        43500.        0.     6900.      3          0.00
  51.       23.       47.       23.       0.       2          3          1        93500.        0.     6900.      3          0.00
  51.       23.       53.       24.       0.       2          3          2            0.    70900.     5100.      3          0.00
  53.       24.       54.       27.       0.       2          3          2            0.    70900.     3400.      3          0.00
  43.       23.       39.       22.       0.       2          3          1        72600.        0.     5100.      3          0.00
  43.       23.       47.       23.       0.       2          3          1            0.    74400.     5100.      3          0.00
  36.       20.       36.       15.       0.       2          3          1        72600.        0.     5100.      3          0.00
  36.       20.       39.       22.       0.       2          3          2            0.    72600.     5100.      3          0.00
  36.       19.       35.       16.       0.       2          3          1        60800.        0.     5100.      3          0.00
  30.       11.       28.       11.       0.       2          3          2        60800.     6500.     3300.      3          0.00
  30.       11.       33.       12.       0.       2          3          2            0.    60800.     5100.      3          0.00
  33.       12.       35.       16.       0.       2          3          1            0.    60800.     5100.      3          0.00
  24.       13.       24.       15.       0.       2          3          2        33300.    34900.     5000.      3          0.00
  24.       13.       24.       12.       0.       2          3          2        34900.    33300.     5000.      3          0.00
  24.       10.       28.       11.       0.       2          3          2         7900.    65300.     3300.      3          0.00
  24.       10.       24.       12.       0.       2          3          2        33300.    34900.     5000.      3          0.00
  24.       10.       24.       10.       0.       2          3          2        68800.     9700.     5000.      3          0.00
  28.       11.       28.       11.       0.       2          3          2         7900.    65300.     5000.      3          0.00
  24.       15.       23.       21.       0.       2          3          2        30700.    31900.     5000.      3          0.00
  23.       20.       23.       21.       0.       2          3          2        25400.    28200.     1400.      3          0.00
  23.       21.       23.       25.       0.       2          3          2        19300.    27200.     4200.      3          0.00
  54.       27.       56.       31.       0.       2          3          2        60200.        0.     6900.      3          0.00
  54.       27.       56.       31.       0.       2          3          2            0.   141700.     6900.      3          0.00
  56.       31.       57.       36.       0.       2          3          2            0.   141700.     6900.      3          0.00
  56.       31.       57.       36.       0.       2          3          2        52400.        0.     6900.      3          0.00
  63.       57.       61.       60.       0.       2          3          2            0.    61800.     5100.      3          0.00
  77.       70.       74.       67.       0.       2          3          2        56600.        0.     6900.      3          0.00
  77.       70.       82.       72.       0.       2          3          2            0.    56600.     6900.      3          0.00
  77.       70.       82.       72.       0.       2          3          2       102300.        0.     6900.      3          0.00
  77.       70.       74.       67.       0.       2          3          2            0.   102300.     6900.      3          0.00
  74.       67.       64.       56.       2.       2          3          2        56600.        0.     6900.      3          0.00
  74.       67.       63.       54.       2.       2          3          2            0.   102300.     6900.      3          0.00
  54.       47.       53.       47.       0.       3          2          2        42300.        0.     3300.      4          0.00
  63.       54.       59.       51.       0.       1          1          2        40400.        0.     7100.      1          0.00
  63.       54.       60.       52.       0.       1          1          2            0.    46500.     2400.      1          0.00
  60.       52.       59.       51.       0.       3          2          2            0.    58900.     6900.      4          0.00
  59.       51.       58.       50.       0.       3          2          2        47600.        0.     6900.      4          0.00
  59.       51.       58.       50.       0.       3          2          2            0.    58600.     6900.      4          0.00
  58.       50.       56.       48.       0.       3          2          2            0.    58600.     6900.      4          0.00
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58.   50.   56.   48.   0.   3   2   2    76700.       0.   6900.   4   0.00
56.   48.   55.   47.   0.   3   2   2    76700.       0.   6900.   4   0.00
56.   48.   55.   47.   0.   3   2   2        0.   43100.   6900.   4   0.00
55.   47.   55.   46.   0.   3   2   2    76700.       0.   6900.   4   0.00
55.   47.   56.   46.   0.   3   2   2        0.   59300.   6900.   4   0.00
56.   46.   56.   42.   0.   3   2   2        0.   41100.   6900.   4   0.00
55.   46.   56.   43.   0.   3   2   2    76700.       0.   6900.   4   0.00
54.   45.   55.   44.   0.   3   2   2    44000.       0.   1400.   4   0.00
57.   51.   56.   52.   0.   3   2   2    63200.    1700.   2800.   4   0.00
53.   47.   52.   48.   0.   3   2   2    55700.       0.   2500.   4   0.00
51.   45.   53.   45.   0.   1   1   2    54500.       0.   7100.   1   0.00
51.   45.   47.   48.   0.   3   2   2        0.   47300.   6900.   4   0.00
55.   44.   56.   43.   0.   3   2   2    80300.       0.   3400.   4   0.00
56.   43.   56.   42.   0.   3   2   2   157100.       0.   6900.   4   0.00
56.   42.   57.   36.   0.   3   2   2   157100.       0.   5100.   4   0.00
56.   42.   57.   36.   0.   3   2   2        0.   72400.   6900.   4   0.00
23.   25.   23.   30.   0.   2   3   2    22900.   34300.   4200.   3   0.00
22.   41.   22.   43.   0.   2   3   2    18700.   30000.   4200.   3   0.00
22.   43.   21.   47.   0.   2   3   2    18500.   56100.   4200.   3   0.00
21.   47.   25.   48.   0.   2   3   2    11900.   48100.   2800.   3   0.00
37.   47.   37.   47.   0.   3   2   2     5600.   35200.   2800.   4   0.00
22.   78.   23.   65.   1.   2   3   1        0.   57300.   3400.   3   0.00
23.   69.   24.   68.   0.   2   3   2        0.   57300.   5100.   3   0.00
24.   68.   24.   67.   0.   2   3   2        0.   57300.      0.   3   0.00
24.   67.   25.   66.   0.   2   3   2        0.   57300.   6900.   3   0.00
25.   48.   25.   50.   0.   2   3   2    14300.   30000.   5000.   3   0.00
25.   52.   25.   54.   0.   3   2   2    32300.   16900.   5000.   4   0.00
25.   52.   28.   52.   0.   3   2   2    11100.   41000.   3300.   4   0.00
25.   54.   25.   55.   0.   3   2   2    34800.   12700.   5000.   4   0.00
28.   52.   31.   52.   0.   3   2   2    12700.   46400.   3300.   4   0.00
31.   52.   36.   53.   0.   3   2   2     5400.   58500.   5000.   4   0.00
36.   53.   36.   54.   0.   1   1   2        0.   40500.   2400.   1   0.00
36.   53.   40.   53.   0.   3   2   2    17700.   36900.   5000.   4   0.00
36.   54.   40.   56.   0.   3   2   2        0.   40500.   2500.   4   0.00
37.   47.   37.   49.   0.   3   2   2     5200.   39700.   2800.   4   0.00
37.   49.   36.   51.   0.   3   2   2     7800.   38000.   2800.   4   0.00
40.   51.   43.   52.   0.   3   2   2     1700.   61600.   5000.   4   0.00
47.   52.   43.   52.   0.   1   1   2    60200.       0.   2100.   1   0.00
47.   52.   47.   52.   0.   1   1   2    60200.       0.   1400.   1   0.00
47.   52.   48.   52.   0.   1   1   2        0.   75800.   2100.   1   0.00
48.   52.   49.   52.   0.   1   1   2        0.   78500.   2100.   1   0.00
49.   57.   48.   57.   0.   1   1   2    54100.       0.   2100.   1   0.00
49.   57.   50.   57.   0.   1   1   2        0.   56000.   2100.   1   0.00
57.   57.   57.   58.   0.   1   1   2    74400.       0.   2500.   1   0.00
57.   57.   57.   57.   0.   1   1   2        0.   73600.   2500.   1   0.00
57.   58.   56.   59.   0.   1   1   2    47300.       0.   2800.   1   0.00
51.   53.   50.   52.   0.   1   1   2    46600.       0.   2100.   1   0.00
51.   53.   52.   53.   0.   1   1   2        0.   50200.   2100.   1   0.00
50.   52.   49.   52.   0.   1   1   2    44400.       0.   2100.   1   0.00
49.   52.   49.   52.   0.   1   1   2    44500.       0.   2100.   1   0.00
49.   52.   49.   50.   0.   1   1   2     2900.   38200.   4200.   1   0.00
49.   50.   50.   50.   0.   1   1   2        0.   44700.   2100.   1   0.00
50.   50.   51.   50.   0.   1   1   2        0.   44700.   2100.   1   0.00
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   51.       50.       51.       49.        0.      1         1         2          0.    47300.     2100.     1         0.00
   52.       51.       51.       50.        0.      1         1         2      59400.        0.     3600.     1         0.00
   52.       51.       53.       51.        0.      1         1         2          0.    54800.     2800.     1         0.00
   53.       51.       53.       51.        0.      1         1         2      54800.        0.     2800.     1         0.00
   53.       51.       54.       52.        0.      1         1         2      10400.    54800.     2400.     1         0.00
   51.       49.       52.       48.        0.      3         2         2          0.    45800.     2500.     4         0.00
   57.       53.       56.       52.        0.      1         1         2        200.    48600.     2400.     1         0.00
   61.       60.       60.       62.        0.      3         2         2          0.    61800.     3400.     4         0.00
   60.       62.       58.       62.        0.      3         2         2          0.    61800.     1400.     4         0.00
   58.       60.       58.       60.        0.      1         1         2      46600.        0.     1400.     1         0.00
   58.       60.       57.       62.        0.      1         1         2      41900.        0.     1400.     1         0.00

 LATITUDE = 38.6 DEG.
 POPULATION =    2.4 MILLICN
 CENTER-CITY COORDINATES-- 31.5KM. N.  40.5KM. E

 NO. OF RECEPTORS=  1--THEIR ID'S AND COORDINATES (X.Y--KM.) FOLLOW--
    1 31.00 31.00

 NO. OF WIND STA.=  1--THEIR ID'S AND COORDINATES (X.Y--KM.) FOLLOW--
    1 32.00 33.00
 STREET CANYON MODEL USED--NO
 TRAFFIC/LINE-SOURCE MODEL USED--NO

 HOLIDAY--        -0
 1ST/LAST HOURS  18  18
 A   VERAGE UPWIND CONC. (UG/M3) OF HC FOR 16 DIRECT. (1=NNE)--
600.   700.   500.   500.   400.   300.   250.   300.   400.   450.   500.   200.   550.   450.   500.   500.


DIRECT INPUT OF MIXING DEPTH --NO

    RAOB INPUTS--
DENVER           82    8   26    84    58    -0
                      15.8                993.0
                      18.3                989.0
                      21.5                981.0
                      22.6                977.0
                      21.9                946.0
                      15.4                850.0
                       9.7                783.0
                       7.6                729.0
                       5.5                700.0
                       2.0                630.0
                      -9.5                500.0

 MET. DATA INPUTS--
HOUR      0    1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23
CLOUD     0    0    0    0    0    0    0    0    0    0    0    0    0    1    1    1    1    0    0    0    0    0    0    0
TEMP.    67   66   66   65   64   61   61   65   68   72   76   79   81   82   83   84   82   80   76   71   68   64   61   60
DIR.      0   27   26   33   27   27   36    3    6    9   12   15   18   21   24   27   30   33   34   36    1    2    1   36
SPEED   0.0  4.0  4.0 16.0  4.0  4.0  4.0  5.0 10.0  5.0  5.0  5.0 10.0 13.0 14.0 14.0  9.0  5.0 13.0 10.0  9.0  8.0  7.0  7.0
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3.00KM GRID OF PRI  HC  EMISSIONS IN G/HR FCR AREA= DENVE ALT=HI NONCAL  YEAR=1982 SEASON=3 DAY=5 HOUR=1800 TEMP=75.F

NORTH   GRIDS EAST--
GRIDS   1       2       3       4       5       6       7       8       9       10      11      12      13      14      15
  25    0.      0.      0.      0.      0.      0.      0.      .63E+060.       0.      0.      0.      0.      0.      0.
  24    0.      0.      0.      0.      0.      0.      0.      .63E+060.       0.      0.      0.      0.      0.      0.
  23    0.      0.      0.      0.      0.      0.      0.      .82E+050.       0.      0.      0.      0.      0.      0.
  22    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  21    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  20    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  19    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  18    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  17    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  16    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  15    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  14    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  13    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  12    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  11    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  10    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   9    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   8    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   7    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   6    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   5    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   4    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   3    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   2    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   1    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

NORTH   GRIDS EAST--
GRIDS   16      17      18      19      20      21      22      23      24      25
  25    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  24    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  23    0.      0.      0.      0.      0.      0.      0.      0.      0.      .15E+07
  22    0.      0.      0.      0.      0.      0.      0.      0.      .20E+07 .12E+07
  21    0.      0.      0.      0.      0.      0.      0.      .16E+07 .16E+070.
  20    0.      0.      0.      0.      0.      0.      .12E+07 .19E+070.       0.
  19    0.      0.      0.      0.      0.      .21E+06 .20E+070.       0.      0.
  18    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  17    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  16    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  15    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  14    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  13    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  12    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  11    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  10    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   9    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   8    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   7    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   6    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   5    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   4    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   3    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   2    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   1    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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3.00KM GRID OF SEC  HC  EMISSIONS IN G/HR FOR AREA= DENVE ALT=HI NONCAL  YEAR=1982 SEASON=3 DAY=5 HOUR=1800 TEMP=75.F

NORTH    GRIDS EAST--
GRIDS          1          2          3          4          5          6          7          8          9         10         11         12         13         14         15
   25    0.         0.         0.         0.         0.         0.         0.             .41E+070.         0.         0.         0.         0.         0.         0.
   24    0.         0.         0.         0.         0.         0.         0.             .41E+070.         0.         0.         0.         0.         0.         0.
   23    0.         0.         0.         0.         0.         0.         0.             .24E+07    .17E+070.         0.         0.             .12E+07    .17E+07    .93E+06
   22    0.         0.         0.         0.         0.         0.         0.             .45E+06    .37E+07    .19E+07    .19E+07    .22E+07    .74E+06    .11E+06    .16E+07
   21    0.         0.         0.         0.         0.         0.             .10E+06    .35E+06    .22E+070.         0.         0.             .13E+07    .15E+07    .30E+06
   20    0.         0.         0.         0.         0.         0.             .45E+060.             .22E+070.         0.         0.         0.             .96E+06    .54E+06
   19    0.         0.         0.         0.         0.         0.             .10E+07    .44E+06    .19E+07    .62E+05    .76E+05    .77E+05    .10E+07    .28E+07    .27E+07
   18    0.         0.         0.         0.             .81E+06    .11E+07    .24E+07    .13E+07    .26E+07    .14E+07    .19E+07    .16E+07    .23E+07    .32E+07    .25E+07
   17    0.         0.             .22E+06    .66E+06    .94E+050.             .67E+060.             .21E+07    .72E+06    .17E+07    .14E+07    .24E+07    .72E+06    .55E+06
   16    0.         0.             .75E+06    .13E+06    .13E+06    .13E+06    .72E+06    .38E+07    .23E+07    .13E+07    .14E+07    .12E+07    .25E+07    .12E+07    .45E+06
   15    0.         0.             .60E+06    .15E+06    .12E+07    .14E+07    .14E+07    .28E+07    .30E+05    .25E+06    .39E+06    .11E+07    .39E+06    .90E+05    .15E+07
   14    0.         0.             .60E+060.             .13E+070.         0.             .22E+07    .98E+06    .14E+07    .30E+060.             .12E+07    .87E+06    .17E+06
   13    0.         0.             .65E+06    .12E+07    .24E+07    .83E+06    .33E+06    .17E+070.             .80E+06    .70E+06    .11E+05    .94E+06    .31E+060.
   12    0.         0.             .12E+07    .24E+06    .26E+060.         0.             .13E+070.             .63E+06    .63E+060.             .90E+060.             .16E+06
   11    0.         0.             .41E+06    .24E+06    .26E+060.         0.             .16E+07    .60E+06    .61E+06    .12E+07    .12E+07    .20E+07    .61E+06    .19E+06
   10    0.         0.             .41E+06    .24E+06    .35E+06    .26E+06    .14E+07    .29E+07    .21E+06    .12E+07    .30E+06    .22E+06    .38E+06    .14E+070.
    9    0.         0.             .30E+06    .46E+06    .73E+06    .17E+06    .17E+06    .23E+07    .11E+07    .41E+06    .63E+06    .27E+05    .34E+06    .13E+07    .53E+06
    8    0.         0.             .87E+05    .21E+06    .53E+06    .53E+060.             .16E+07    .13E+07    .15E+060.             .96E+06    .22E+07    .50E+07    .71E+07
    7    0.         0.         0.             .26E+060.             .79E+05    .64E+06    .29E+07    .21E+06    .43E+06    .58E+06    .31E+07    .30E+07    .18E+07    .34E+06
    6    0.         0.         0.             .27E+06    .79E+04    .13E+05    .53E+05    .25E+070.         0.         0.             .40E+07    .89E+06    .15E+070.
    5    0.         0.         0.             .15E+06    .14E+06    .69E+050.             .73E+06    .11E+070.             .11E+07    .30E+07    .21E+07    .81E+06    .14E+06
    4    0.         0.         0.             .11E+060.             .17E+060.         0.             .51E+07    .31E+07    .40E+07    .11E+070.         0.             .64E+06
    3    0.         0.         0.         0.         0.         0.         0.         0.             .21E+07    .12E+07    .46E+060.         0.         0.         0.
    2    0.         0.         0.         0.         0.         0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
    1    0.         0.         0.         0.         0.         0.         0.         0.         0.         0.         0.         0.         0.         0.         0.

NORTH    GRIDS EAST--
GRIDS         16         17         18         19         20         21         22         23         24         25
   25    0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
   24    0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
   23    0.         0.             .38E+06    .74E+060.         0.         0.         0.         0.             .93E+07
   22        .24E+07    .12E+07    .12E+07    .45E+05    .60E+060.         0.         0.             .49E+07    .31E+07
   21        .44E+06    .57E+06    .68E+06    .12E+07    .24E+07    .17E+070.             .40E+07    .40E+070.
   20        .53E+06    .51E+06    .12E+07    .14E+07    .55E+06    .38E+07    .31E+07    .49E+070.         0.
   19        .30E+07    .14E+07    .70E+06    .64E+06    .96E+06    .39E+07    .53E+070.         0.         0.
   18        .15E+07    .16E+07    .13E+07    .20E+07    .30E+07    .18E+070.         0.         0.         0.
   17        .15E+07    .15E+07    .27E+07    .37E+07    .37E+07    .36E+060.         0.         0.         0.
   16        .24E+07    .31E+07    .32E+07    .61E+07    .44E+06    .20E+06    .12E+060.         0.         0.
   15        .13E+07    .11E+07    .26E+07    .82E+07    .97E+06    .21E+06    .27E+060.         0.         0.
   14        .39E+06    .83E+06    .12E+07    .64E+070.         0.             .17E+060.         0.         0.
   13        .19E+06    .11E+07    .12E+06    .64E+070.         0.             .16E+060.         0.         0.
   12        .34E+06    .13E+07    .35E+06    .76E+07    .21E+07    .57E+05    .17E+060.         0.         0.
   11        .86E+06    .59E+06    .27E+06    .76E+07    .58E+06    .15E+07    .99E+050.         0.         0.
   10        .84E+06    .34E+06    .11E+07    .82E+07    .29E+05    .23E+07    .20E+07    .56E+050.         0.
    9        .52E+060.             .35E+07    .55E+07    .26E+07    .30E+060.             .10E+070.         0.
    8        .61E+07    .54E+07    .55E+07    .94E+070.             .15E+06    .12E+060.         0.         0.
    7    0.         0.         0.             .65E+07    .61E+06    .95E+050.         0.         0.         0.
    6    0.         0.         0.             .66E+06    .65E+070.         0.         0.         0.         0.
    5    0.         0.         0.             .13E+05    .72E+070.         0.         0.         0.         0.
    4        .78E+06    .13E+060.             .13E+07    .50E+070.         0.         0.         0.         0.
    3    0.             .63E+06    .76E+06    .68E+06    .14E+060.         0.         0.         0.         0.
    2    0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
    1    0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
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3.00KM GRID OF TOT  HC  EMISSIONS IN G/HR FOR AREA= DENVE ALT=HI NONCAL  YEAR=1982 SEASON=3 DAY=5 HOUR=1800 TEMP=75.F

NORTH   GRIDS EAST--
GRIDS      1       2       3       4       5       6       7       8       9       10      11      12      13      14      15
   25   0.      0.      0.      0.      0.      0.      0.       .47E+070.      0.      0.      0.      0.      0.      0.
   24   0.      0.      0.      0.      0.      0.      0.       .47E+070.      0.      0.      0.      0.      0.      0.
   23   0.      0.      0.      0.      0.      0.      0.       .25E+07 .17E+070.      0.      0.       .12E+07 .17E+07 .93E+06
   22   0.      0.      0.      0.      0.      0.      0.       .45E+06 .37E+07 .19E+07 .19E+07 .22E+07 .74E+06 .11E+06 .16E+07
   21   0.      0.      0.      0.      0.      0.       .10E+06 .35E+06 .22E+070.      0.      0.       .13E+07 .15E+07 .30E+06
   20   0.      0.      0.      0.      0.      0.       .45E+060.       .22E+070.      0.      0.      0.       .96E+06 .54E+06
   19   0.      0.      0.      0.      0.      0.       .10E+07 .44E+06 .19E+07 .62E+05 .76E+05 .77E+05 .10E+07 .28E+07 .27E+07
   18   0.      0.      0.      0.       .81E+06 .11E+07 .24E+07 .13E+07 .26E+07 .14E+07 .19E+07 .16E+07 .23E+07 .32E+07 .25E+07
   17   0.      0.       .22E+06 .66E+06 .94E+050.       .67E+060.       .21E+07 .72E+06 .17E+07 .14E+07 .24E+07 .72E+06 .55E+06
   16   0.      0.       .75E+06 .13E+06 .13E+06 .13E+06 .72E+06 .38E+07 .23E+07 .13E+07 .14E+07 .12E+07 .25E+07 .12E+07 .45E+06
   15   0.      0.       .60E+06 .15E+06 .12E+07 .14E+07 .14E+07 .28E+07 .30E+05 .25E+06 .39E+06 .11E+07 .39E+06 .90E+05 .15E+07
   14   0.      0.       .60E+060.       .13E+070.      0.       .22E+07 .98E+06 .14E+07 .30E+060.       .12E+07 .87E+06 .17E+06
   13   0.      0.       .65E+06 .12E+07 .24E+07 .83E+06 .33E+06 .17E+070.       .80E+06 .70E+06 .11E+05 .94E+06 .31E+060.
   12   0.      0.       .12E+07 .24E+06 .26E+060.      0.       .13E+070.       .63E+06 .63E+060.       .90E+060.       .16E+06
   11   0.      0.       .41E+06 .24E+06 .26E+060.      0.       .16E+07 .60E+06 .61E+06 .12E+07 .12E+07 .20E+07 .61E+06 .19E+06
   10   0.      0.       .41E+06 .24E+06 .35E+06 .26E+06 .14E+07 .29E+07 .21E+06 .12E+07 .30E+06 .22E+06 .38E+06 .14E+070.
    9   0.      0.       .30E+06 .46E+06 .73E+06 .17E+06 .17E+06 .23E+07 .11E+07 .41E+06 .63E+06 .27E+05 .34E+06 .13E+07 .53E+06
    8   0.      0.       .87E+05 .21E+06 .53E+06 .53E+060.       .16E+07 .13E+07 .15E+060.       .96E+06 .22E+07 .50E+07 .71E+07
    7   0.      0.      0.       .26E+060.       .79E+05 .64E+06 .29E+07 .21E+06 .43E+06 .58E+06 .31E+07 .30E+07 .18E+07 .34E+06
    6   0.      0.      0.       .27E+06 .79E+04 .13E+05 .53E+05 .25E+070.      0.      0.       .40E+07 .89E+06 .15E+070.
    5   0.      0.      0.       .15E+06 .14E+06 .69E+050.       .73E+06 .11E+070.       .11E+07 .30E+07 .21E+07 .81E+06 .14E+06
    4   0.      0.      0.       .11E+060.       .17E+060.      0.       .51E+07 .31E+07 .40E+07 .11E+070.      0.       .64E+06
    3   0.      0.      0.      0.      0.      0.      0.      0.       .21E+07 .12E+07 .46E+060.      0.      0.      0.
    2   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    1   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

NORTH   GRIDS EAST--
GRIDS      16      17      18      19      20      21      22      23      24      25
   25   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   24   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   23   0.      0.       .38E+06 .74E+060.      0.      0.      0.      0.       .11E+08
   22    .24E+07 .12E+07 .12E+07 .45E+05 .60E+060.      0.      0.       .69E+07 .43E+07
   21    .44E+06 .57E+06 .68E+06 .12E+07 .24E+07 .17E+070.       .56E+07 .56E+070.
   20    .53E+06 .51E+06 .12E+07 .14E+07 .55E+06 .38E+07 .43E+07 .69E+070.      0.
   19    .30E+07 .14E+07 .70E+06 .64E+06 .96E+06 .41E+07 .73E+070.      0.      0.
   18    .15E+07 .16E+07 .13E+07 .20E+07 .30E+07 .18E+070.      0.      0.      0.
   17    .15E+07 .15E+07 .27E+07 .37E+07 .37E+07 .36E+060.      0.      0.      0.
   16    .24E+07 .31E+07 .32E+07 .61E+07 .44E+06 .20E+06 .12E+060.      0.      0.
   15    .13E+07 .11E+07 .26E+07 .82E+07 .97E+06 .21E+06 .27E+060.      0.      0.
   14    .39E+06 .83E+06 .12E+07 .64E+070.      0.       .17E+060.      0.      0.
   13    .19E+06 .11E+07 .12E+06 .64E+070.      0.       .16E+060.      0.      0.
   12    .34E+06 .13E+07 .35E+06 .76E+07 .21E+07 .57E+05 .17E+060.      0.      0.
   11    .86E+06 .59E+06 .27E+06 .76E+07 .58E+06 .15E+07 .99E+050.      0.      0.
   10    .84E+06 .34E+06 .11E+07 .82E+07 .29E+05 .23E+07 .20E+07 .56E+050.      0.
    9    .52E+060.       .35E+07 .55E+07 .26E+07 .30E+060.       .10E+070.      0.
    8    .61E+07 .54E+07 .55E+07 .94E+070.       .15E+06 .12E+060.      0.      0.
    7   0.      0.      0.       .65E+07 .61E+06 .95E+050.      0.      0.      0.
    6   0.      0.      0.       .66E+06 .65E+070.      0.      0.      0.      0.
    5   0.      0.      0.       .13E+05 .72E+070.      0.      0.      0.      0.
    4    .78E+06 .13E+060.       .13E+07 .50E+070.      0.      0.      0.      0.
    3   0.       .63E+06 .76E+06 .68E+06 .14E+060.      0.      0.      0.      0.
    2   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
    1   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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820826    HC DENVER
 CONCENTRATIONS (CO=100-UG/M3,HC=10-UG/M3,NOX=UG/M3) LOCAL WIND SPEEDS/DIRECTIONS (M/S, DEG)--

                                                     HOURS
        18
CLOUD     0
TEMP--K  297
STAB.      4
MIX HT 1052.

    STATION     1
WND SPD     7
WND DIR   340
CONCEN    77.
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